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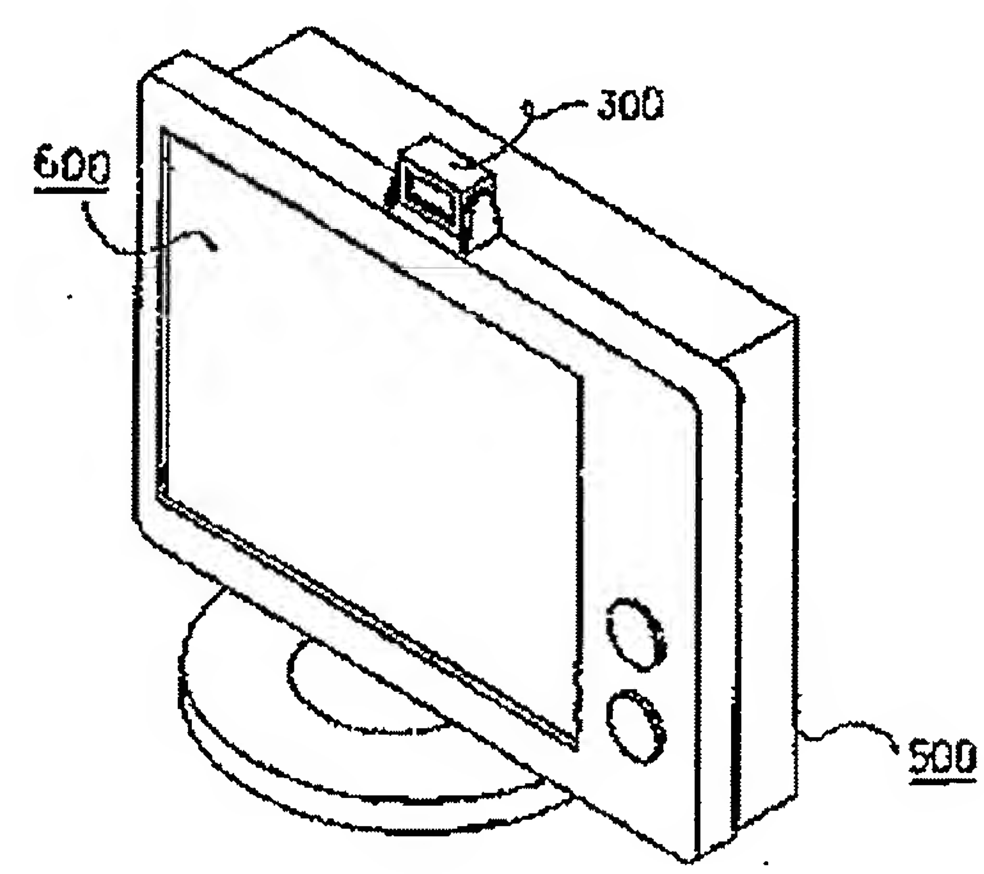
(54)【発明の名称】　立体ディスプレイ装置

(57)【要約】

【課題】　簡易な構造でありながら、高速に立体視領域を追従させることが可能な立体ディスプレイ装置を得ること。

【解決手段】　右眼用の視差画像と左眼用の視差画像から構成するストライプ画像を画像表示手段に表示し、該ストライプ画像からの光束をレンチキュラレンズやパララックス・バリヤ等で両眼視差画像を表示し、所定の立体視領域を形成して観察者に立体像を観察させる立体ディスプレイ装置において、該観察者を変調した赤外光で照射する赤外光投光手段と該観察者が反射する該変調した赤外光を選択的に受光する受光手段とを備えた頭部位置検出手段を有し、該頭部位置検出手段が検出する該観察者の頭部位置に基づいて立体視領域を移動させる手段が該立体視領域を追従させる。



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【特許請求の範囲】

【請求項１】 右眼用の視差画像と左眼用の視差画像を夫々ストライプ状のストライプ画素に分割し、これらのストライプ画素を所定の順序で並べて構成するストライプ画像を画像表示手段に表示し、該ストライプ画像からの光束をレンチキュラレンズやパララックス・バリヤ等で両眼視差画像を表示し、所定の立体視領域を形成して観察者に立体像を観察させる立体ディスプレイ装置において、

該観察者を変調した赤外光で照射する赤外光投光手段と該観察者が反射する該変調した赤外光を選択的に受光する受光手段とを備えた頭部位置検出手段を有し、該頭部位置検出手段が検出する該観察者の頭部位置に基づいて立体視領域を移動させる手段が該立体視領域を追従させることを特徴とする立体ディスプレイ装置。

【請求項２】 前記立体視領域を追従させる手段は前記観察者の頭部位置に基づいて前記レンチキュラレンズ若しくは前記パララックス・バリヤを移動して前記立体視領域を移動させることを特徴とする請求項１の立体ディスプレイ装置。

【請求項３】 前記赤外光投光手段は上下方向の投光範囲を制限する絞り手段を有することを特徴とする請求項１又は２の立体ディスプレイ装置。

【請求項４】 前記赤外光投光手段又は赤外光受光手段は垂直面内で前記赤外光の照射方向又は受光方向を調整できる調整機構を有することを特徴とする請求項３の立体ディスプレイ装置。

【請求項５】 前記赤外光投光手段はこれが照射する赤外光を所定の周波数で変調し、前記受光手段は前記観察者が反射する赤外光を同期手段により該変調と同期して受光することを特徴とする請求項１～４のいずれか１項に記載の立体ディスプレイ装置。

【請求項６】 前記赤外光投光手段の変調周波数を前記画像表示手段の表示周波数の整数倍と異なる様に設定していることを特徴とする請求項５の立体ディスプレイ装置。

【請求項７】 前記観察者が反射する赤外光を前記受光手段で受光する際、該受光手段が受光する赤外光の量が一定になるように前記赤外光発光手段の発光強度を制御することを特徴とする請求項１～６のいずれか１項に記載の立体ディスプレイ装置。

【請求項８】 前記頭部位置検出手段は2 つの前記受光手段を水平方向に離して備え、該2 つの受光手段の出力の差分から、或いは該差分を該2 つの受光手段の出力和で除した値から、前記観察者の頭部位置を検出することを特徴とする請求項１～７のいずれか１項に記載の立体ディスプレイ装置。

【請求項９】 前記受光手段は水平方向に複数の画素を配置したラインセンサであり、該ラインセンサ上に前記観察者の像を結像させ、該ラインセンサからの信号より

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検知する該像の重心位置に基づいて該観察者の頭部位置を検出することを特徴とする請求項１～７のいずれか１項に記載の立体ディスプレイ装置。

【請求項１０】 前記ラインセンサの各画素からの信号を2 値化手段により所定の閾値よりハイレベル若しくはローレベルの2 値に変換し、該2 値化された信号のハイレベルの最大幅を幅検出手段により検出し、その中心位置を前記観察者の頭部位置とすることを特徴とする請求項９の立体ディスプレイ装置。

【請求項１１】 前記ラインセンサの各画素からの信号の最大値又は積分値に応じて、前記赤外光投光手段の発光強度を制御することを特徴とする請求項９又は１０の立体ディスプレイ装置。

【請求項１２】 前記ラインセンサの各画素からの信号の最大値又は積分値に応じて、該ラインセンサからの信号の増幅率を制御することを特徴とする請求項９～１１のいずれか１項に記載の立体ディスプレイ装置。

【請求項１３】 前記ラインセンサの各画素からの出力の最大値又は積分値に応じて、前記閾値を制御することを特徴とする請求項９～１２のいずれか１項に記載の立体ディスプレイ装置。

【請求項１４】 前記検出されたハイレベルの最大幅が所定幅の範囲以内か否かを判断手段により判断し、所定の幅の範囲以内のときに前記観察者の頭部位置情報を更新することを特徴とする請求項１０～１３のいずれか１項に記載の立体ディスプレイ装置。

【請求項１５】 前記検出されたハイレベルの最大幅の両端のいずれかが検知範囲の最大値又は最小値と一致するか否かを判断手段により判断し、一致しない時に前記観察者の頭部位置情報を更新することを特徴とする請求項１０～１４のいずれか１項に記載の立体ディスプレイ装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は立体ディスプレイ装置に関し、特に立体画像の表示を行うテレビ、ビデオ、コンピュータモニタ、ゲームマシンなどに好適なものである。

【０００２】

【従来の技術】従来、立体ディスプレイの方式として、右眼用視差画像と左眼用視差画像とを夫々偏光状態を異ならせて表示し、観察者が偏光めがねを用いて左右の視差画像を分離して立体画像として視認させるものがある。例えば、左右の視差画像の偏光状態を異ならせるためにディスプレイ側に液晶シャッターを設け、ディスプレイの表示画像のフィールド信号に同期して、偏光状態を切り替え、偏光めがねをかけた観察者が時分割で片目づつ左右画像を分離して立体視を可能にする方式が実用化されている。

【０００３】さらに、めがね側に液晶シャッタを設け、

これをモニタの表示画像に同期させることで左右の視差画像を適切に視認させて観察者に立体画像を認識させる等の幾つかの方式も実用化されている。

【０００４】しかし、これらの方式では観察者は常に立体視用のめがねをかけねばならないという欠点があった。

【０００５】それに対して、偏光めがねを用いない立体ディスプレイ方式として、画像表示面の前面にレンチキュラレンズを設け、空間的に左右の眼にはいる画像を分離するレンチキュラレンズ方式がある。

【０００６】図16は従来のレンチキュラレンズ方式の立体ディスプレイ装置の説明図である。図中、151 は液晶ディスプレイで、液晶の表示画素部153 はガラス基板152 、154 の間に形成されている。液晶ディスプレイ151 の観察者側には、断面が図示のように半円状で各々紙面の直角方向に延びる多数のシリンドリカルレンズからなるレンチキュラレンズ155 を設けており、その焦点面に液晶の表示画素部153が位置するようにしている。

【０００７】表示画素部153 にはストライプ画像を表示している。このストライプ画像について説明する。ストライプ画像は複数視点からの複数の視差画像（視差のある画像）より合成する。ストライプ画像を合成するには少なくとも2 つの視差画像を必要とする。ここで、右眼に対応する視差画像をR_s、左眼に対応する視差画像をL_sとする。各視差画像を縦長のストライプ状の画素群（以下ストライプ画素という）R_i ,L_i (i=1,2,3･･･)に分割する。そして、各視差画像から得られるストライプ画素を交互に配列し、即ち各ストライプ画素をR_1 ,L_2 ,R_3 ,L_4 ･･･(又は、L_1 ,R_2 ,L_3 ,R_4 ,･･･）と配列して1 つの画像を構成したものがストライプ画像である。以下、本明細書で言う3 次元画像とはこのストライプ画像である。又、以上のストライプ画像を形成することをストライプ合成という。

【０００８】もし、視差画像がA,B,C の3 つであれば、ストライプ画像は各ストライプ画素をA_1 ,B_2 ,C_3 ,A_4 ,B_5 ,C_6 ,･･･、若しくはB_1 ,C_2 ,A_3 ,B_4 ,C_5 ,A_6 ･･･、若しくは C_1 ,A_2 ,B_3 ,C_4 ,A_5 ,B_6 ･･･と並べた画像となる。

【０００９】表示画素部153 には図示のようにレンチキュラレンズの一つのピッチに対応して紙面の直角方向に延びるストライプ状の右眼用ストライプ画素（黒塗りの部分）、左眼用ストライプ画素（白抜きの部分）を対として交互に配置しており、これらのストライプ画素からの光束はレンチキュラレンズ155 により観察者の右眼E_R、左眼E_Lの在る領域に光学的に分離され、立体視が可能となる。

【００１０】図中にはディスプレイ151 の両端と中央部分の右眼用、左眼用画像の各々を観察できる空間的領域を示してあり、画面全面にわたって観察者の眼（両眼中心距離はe ）に左右分離して見える共通領域は図中の太線部分の立体視領域156 である。なお、この立体視領域156 に隣接する領域（不図示）においても左右分離して立体視できる立体視領域が存在する。

【００１１】又、めがね無し立体表示方式としては前述のレンチキュラレンズ方式の他にパララックスバリヤ方式がある。以下、このパラックスバリヤ方式について説明する。

【００１２】パララックス・バリヤ法を用いる立体画像表示方式はS. H. Kaplanによってその技術が開示されている。（" Theory of Parallax Barriers" , J. SMPTE, Vol.59, No.7, pp.11-21,1952）。該方式においても先に説明した左右の視差画像から合成するストライプ画像を表示し、このストライプ画像から所定の距離だけ離れた位置に設けられた所定の開口部を有するスリット（パララックス・バリヤと呼ばれる）を介することにより、観察者は左右それぞれの眼でそれぞれの眼に対応した視差画像を分離して観察して立体視を得るものである。

【００１３】このような従来の装置では、これを通常のテレビの如き2 次元画像表示装置として使用することは出来なかった。

【００１４】そこで特開平3-119889号公報、特開平5-122733号公報においては、パララックス・バリヤを透過型液晶素子などにより電子的に形成し、パララックス・バリヤの形状や位置などを電子的に制御して変化するようにした立体画像表示装置が開示されている。

【００１５】図17は特開平3-119889号公報に開示されている立体画像表示装置の要部概略図である。本装置では画像表示面101 に厚さd のスペーサー102 を介して透過型液晶表示素子から成る電子式パララックス・バリヤ103 を配置している。画像表示面101 には2 方向または多方向から撮像した視差画像から構成した縦のストライプ画像を表示し、一方、電子式パララックス・バリヤ103 にはXYアドレスをマイクロコンピュータ104 等の制御手段で指定することによりバリヤ面上の任意の位置にパララックス・バリヤを形成し、前記パララックス・バリヤ法の原理に従って立体視を可能としている。

【００１６】この装置において、2 次元画像表示を行う際には、電子式パララックス・バリヤ103 にバリヤ・ストライプの形成を止めて、画像表示領域の全域にわたって無色透明な状態にすることで2 次元画像表示を行う。これによって、従来のパララックス・バリヤ法を用いた立体画像表示方式では出来なかった通常の2 次元画像表示装置との両立性を実現している。

【００１７】図18は特開平3-119889号公報に開示されている液晶パネルディスプレイと電子式バリヤによって構成された立体画像表示装置の要部概略図である。この立体画像表示装置では2 枚の液晶層115 、125 をそれぞれ2 枚の偏光板111 、118 および121 、128 で挟み、液晶層115 は画像表示手段、液晶層125 は電子式バリヤ形成手段とした構成にしている。

【００１８】本装置においても、2 次元画像表示を行う

際には、液晶層125 にバリヤ・ストライプの形成を止めて、画像表示領域の全域にわたって無色透明な状態にすることで2 次元画像表示を行い、通常の2 次元画像表示装置との両立性を実現している。

【００１９】また、特開平5-122733号公報には、図19に示すように透過型液晶表示素子から成る電子式パララックス・バリヤ103 の任意の一部領域のみにバリヤ・ストライプのパターンを発生させることが出来る構成とし、3 次元画像と2 次元画像とを同一表示面内で混在表示することを可能とした例が開示されている。

【００２０】上で説明したレンチキュラレンズ方式やパララックス・バリヤ方式のようにストライプ画像を構成・表示して立体視を可能とする立体ディスプレイ装置では、その立体視できる領域の幅は狭く、観察者が立体視できる範囲は最大でも両眼中心距離約65mmの幅の半分しかない。そのため、観察者は頭の位置を固定するようにして観察する必要があり、安定して立体視しにくいという欠点があった。

【００２１】それに対して、特開平2-44995 号公報では、この立体視の領域を広くするために観察者の両眼の位置を検出して、これに応じてレンチキュラレンズと表示素子との左右方向の相対位置を移動制御することで、立体視領域を広げる方式が提案されている。

【００２２】また、特開平2-50145 号公報では観察者の両眼位置を検出し、その信号によりレンチキュラレンズに対応する右眼用視差画像と左眼用視差画像のストライプ画素の左右の位置を入れ替えて、立体視領域を広くする方式が提案されている。

【００２３】ここで、観察者の両眼の位置を検出して立体視領域を広くする手段について簡単に説明する。観察者の両眼位置の検知手段としては、観察者をカメラで捕らえ、その輪郭を抽出したり、観察者をパターンマッチングで探す等の画像処理方法が提案されている。

【００２４】図20はレンチキュラレンズ方式において、観察者の左右方向の移動に際してレンチキュラレンズを追従させる原理の説明図である。図中の400 は異動前の観察者であり、400'は観察者が所定の位置から左右方向に距離a 移動したときの位置である。401 はレンチキュラレンズを構成する１つのシリンドリカルレンズであり、401'は観測者に追従して移動後の該シリンドリカルレンズである。b はこの時シリンドリカルレンズ（＝レンチキュラレンズ）の移動量、402 は右ストライプ画素（黒塗り）と左ストライプ画素（白抜き）を表示する表示画素部、f はシリンドリカルレンズの焦点距離、S は観察距離である。

【００２５】通常、S>>fの関係が成り立つ時、観察者の横方向にa の移動に対してレンチキュラレンズを下記のb

$b=f\cdot a/S$

だけ移動させれば、立体視領域も横方向にa だけ移動する。

【００２６】なお、ここではレンズを移動させる例を説明したが、表示画素部402 をレンチキュラレンズに対して移動させても同様の効果が得られる。

【００２７】上では、観察者が立体ディスプレイに対して左右方向に移動した際に立体視領域を追従させる原理を説明した。しかしながら、観察者は立体ディスプレイに対して左右方向のみならず、奥行き方向にも移動し、場合によっては奥行き方向で立体視領域から外れる可能性もある。

【００２８】特開平4-122922号公報では、この問題点を解決する提案がレンチキュラに3 次元画像を投影表示する方式で開示されている。該提案では、観察者の奥行き方向の位置も検知し、同時に奥行き方向の立体視追従も可能にしている。

【００２９】上記の特開平2-50145 号公報には観察者の左右方向の位置検知手段として、以下の複数の方法が記載されている。

(a) 主に赤外線を投光し、その戻り光を検出する。

(b) 赤外光を観察者に投射し、観察者からの反射光をライン状のCCD イメージセンサに受けて検知する。

(c) 観察者背面から赤外線を投射し、前面に設けた受光器の光量分布より検知する。

(d) TVカメラにより、観察者の画像から輪郭抽出処理を施し、更に画像認識技術により両眼位置を検出する。

【００３０】また、奥行き方向の位置検知手段として、上記の特開平4-122922号公報に以下の複数の手段が記載されている。

(a) 赤外線を用いた距離検出器を2 台用いる方法。

(b) 2 台のカメラの画像処理による方法。

【００３１】

【発明が解決しようとする課題】上記の従来の立体ディスプレイ装置では以下のような課題があった。

【００３２】(1) 赤外線の投受光により観察者の位置を検出するものでは、単なる赤外線の照射と受光によれば、他に赤外光を発生するノイズ等があった場合、観察者からの戻り光とノイズ光の区別がつかないので、検知精度と検知信頼性に悪影響を与える。

【００３３】(2) 観察者をカメラ等で撮像し、画像処理によってその観察位置を検知する立体ディスプレイ装置では、検知に膨大な演算を必要とし、高速検知が困難となり、従って立体視領域の追従の速度が遅くなり、満足できる追従速度が確保できなかった。更に、装置としては高速・高性能な演算機能が必要となるため、コスト高となる問題があった。

【００３４】本発明の目的は、観察者の頭部に赤外光を変調して投光し、その反射光を複数の受光手段で検知する、又はラインセンサの受光手段で反射光を検知し、その出力を適切に処理して、観察者の頭部位置を検出することにより、簡易な構造でありながら、高速に立体視領

域を追従させることが可能な立体ディスプレイ装置の提供である。

【００３５】

【課題を解決するための手段】本発明の立体ディスプレイ装置は、

（１－１） 右眼用の視差画像と左眼用の視差画像を夫々ストライプ状のストライプ画素に分割し、これらのストライプ画素を所定の順序で並べて構成するストライプ画像を画像表示手段に表示し、該ストライプ画像からの光束をレンチキュラレンズやパララックス・バリヤ等の偏向光学素子で両眼視差画像を表示し，所定の立体視領域を形成して観察者に立体像を観察させる立体ディスプレイ装置において、該観察者を変調した赤外光で照射する赤外光投光手段と該観察者が反射する該変調した赤外光を選択的に受光する受光手段とを備えた頭部位置検出手段を有し、該頭部位置検出手段が検出する該観察者の頭部位置に基づいて立体視領域を移動させる手段が該立体視領域を追従させること等を特徴としている。

【００３６】特に、

（１－１－１） 前記立体視領域を追従させる手段は前記観察者の頭部位置に基づいて前記レンチキュラレンズ若しくは前記パララックス・バリヤ等の偏向光学素子を移動して前記立体視領域を移動させる。。

（１－１－２） 前記赤外光投光手段は上下方向の投光範囲を制限する絞り手段を有する。

（１－１－３） 前記赤外光投光手段又は赤外光受光手段は垂直面内で前記赤外光の照射方向又は受光方向を調整できる調整機構を有する。

（１－１－４） 前記赤外光投光手段はこれが照射する赤外光を所定の周波数で変調し、前記受光手段は前記観察者が反射する赤外光を同期手段により該変調と同期して受光する。

（１－１－５） 前記赤外光投光手段の変調周波数を前記画像表示手段の表示周波数の整数倍と異なる様に設定している。

（１－１－６） 前記観察者が反射する赤外光を前記受光手段で受光する際、該受光手段が受光する赤外光の量が一定になるように前記赤外光発光手段の発光強度を制御する。

（１－１－７） 前記頭部位置検出手段は2 つの前記受光手段を水平方向に離して備え、該2 つの受光手段の出力の差分から，或いは該差分を該2 つの受光手段の出力和で除した値から、前記観察者の頭部位置を検出する。

（１－１－８） 前記受光手段は水平方向に複数の画素を配置したラインセンサであり、該ラインセンサ上に前記観察者の像を結像させ，該ラインセンサからの信号より検知する該像の重心位置に基づいて該観察者の頭部位置を検出する。

（１－１－９） 前記ラインセンサの各画素からの信号を2 値化手段により所定の閾値よりハイレベル若しくはローレベルの2 値に変換し，該2 値化された信号のハイレベルの最大幅又は負論理であれば，ローレベルの最大幅を幅検出手段により検出し、その中心位置を前記観察者の頭部位置とする。

（１－１－１０） 前記ラインセンサの各画素からの信号の最大値又は積分値に応じて、前記赤外光投光手段の発光強度を制御する。

（１－１－１１） 前記ラインセンサの各画素からの信号の最大値又は積分値に応じて、該ラインセンサからの信号の増幅率を制御する。

（１－１－１２） 前記ラインセンサの各画素からの出力の最大値又は積分値に応じて、前記閾値を制御する。

（１－１－１３） 前記検出されたハイレベルの最大幅が所定幅の範囲以内か否かを判断手段により判断し、所定の幅の範囲以内のときに前記観察者の頭部位置情報を更新する。

（１－１－１４） 前記検出されたハイレベルの最大幅の両端のいずれかが検知範囲の最大値又は最小値と一致するか否かを判断手段により判断し，一致しない時に前記観察者の頭部位置情報を更新する。こと等を特徴としている。

【００３７】

【発明の実施の形態】図1 は本発明の立体ディスプレイ装置の実施形態1 の外観図である。本実施形態はレンチキュラレンズ方式を用いた立体ディスプレイ装置である。以下、図1から図7 を用いて実施形態1 について説明する。

【００３８】図1 中、500 は本装置全体の記号である。600 はレンチキュラレンズ方式を用いた立体画像表示部である。300 は頭部位置検出センサであり、赤外光投光系（赤外光投光手段）と受光系（受光手段）を備えて観察者の頭部位置を検知する。なお、この頭部位置検出センサ300 は観察者の体格に合わせて垂直面内の赤外光の照射方向と受光方向を調整できる調整機構、即ち上下方向の角度調整機構を備えている。図2 は実施形態1 のシステムのブロック図である。図中、1 はレンチキュラレンズ（以後、レンチキュラと略称する）であり，画像表示手段2 に対して左右方向に移動できる。画像表示手段2 は例えば、液晶表示素子，プラズマ表示素子，CRT 等で構成し、後述するストライプ画像を表示する。

【００３９】400 は観察者，300 は前記の頭部位置検出センサ、3 は頭部位置検出センサ300 からの信号を処理する頭部位置検出回路である。4 は実施形態１全体を制御するコントローラであり，頭部位置検出回路3 で得た頭部位置情報も一つの信号としてこのコントローラへ入力される。5 はスライド機構であり，レンチキュラ1を所定量画像表示手段2 に対して左右方向へ移動させる。6 はスライド機構5 を駆動するスライド駆動回路である。

【００４０】なお、頭部位置検出センサ300 、頭部位置

検出回路3 等は頭部位置検出手段の一要素を構成している。又、スライド機構5 ．スライド駆動回路6 等は立体視領域を追従させる手段の一要素を構成している。

【0041】図3 は実施形態1 のスライド機構5 の説明図である。図中．1aはレンチキュラ1 と一体的に設けたピン．1b、1c．1d、1eはバネの取り付け座である。10a、10b．10c、10d はレンチキュラ1 を左右方向のみに可動とし、筐体（不図示）から所定間隔だけ浮動的に支持する平行板バネである。

【0042】11は11a を回転中心として回転するレバーであり、これに設けた長穴11b に係合するレンチキュラ1 のピン1aを介してレンチキュラ1 を左右に移動制御する。11c はレバーの一部に設けたセクターギアである。12は該レバーを回転させるための動力源である直流モータ．13はレバー11のセクターギア11c を介して動力を伝達させるための歯車である。

【0043】14は磁界を発生させるための永久磁石、15は磁石14の磁束密度を検出するホール素子で、レンチキュラ1 の移動量はこの磁束の変化分として検知され、この値をもとにレンチキュラ1 のスライド量をフィードバック制御する。

【0044】図4 は実施形態1 の頭部位置検出センサ300 の要部斜視図である。図中、20は投光用の光源である赤外発光ダイオード（赤外LED ）、21は観察者の肩より上の頭部を照射するためのシリンドリカルレンズである。B は光源からの照射光束の上下方向の投光範囲を制限する絞り手段である。赤外LED 20．シリンドリカルレンズ21、絞り手段B 等は赤外光投光系（赤外光投光手段）34の一要素を構成している。

【0045】22_R と22_L は観察者に投光した赤外光の反射光を集光するコンデンサレンズ、23_R と23_L は赤外光以外を遮光する赤外光透過フィルタ．24_R と24_L は赤外光を受光して電気信号に変換するホトトランジスタである。コンデンサレンズ22_R ．赤外光透過フィルタ23_R 、ホトトランジスタ24_R 等は右側受光系（受光手段）30_R の一要素を構成しており．コンデンサレンズ22_L ．赤外光透過フィルタ23_L 、ホトトランジスタ24L 等は左側受光系（受光手段）30_L の一要素を構成している。なお、本明細書において記号に付すR 及びL は夫々右側要素及び左側要素であることを表している。

【0046】図5 は頭部位置検出センサ300 の検出原理の説明図である。図中、x はセンサの中心位置（センサの軸）からの頭部の移動量．S は観察者400 からホトトランジスタ24_R と24_L を結んだ線との距離、L_L は観察者400 からホトトランジスタ24_L までの距離、L_R は観察者400 からホトトランジスタ24_R までの距離、d はホトトランジスタとセンサ中心の距離である。

【0047】図6 は本実施形態において、発明者が実験的に求めたホトトランジスタの出力図である。図中、V_R はホトトランジスタ24_R の出力、V_L はホトトランジスタ

24_Lの出力．V_Pは出力値のピークである。これらの出力は観察者400 からホトトランジスタまでの距離L_RとL_Lが最短の位置、即ち、観察者が各ホトトランジスタに正対する位置、即ちx=d 及びx=-dの位置で最大となる。実験データによれば．それぞれのホトトランジスタの出力は最大値の近傍では近似的に二次曲線となるので．ホトトランジスタの光学系や電気系の総合的なパラメータをαとすれば、夫々の出力は

$V_R = V_P - \alpha (x-d)^2$

$V_L = V_P - \alpha (x+d)^2$

と表される。これらの差をとると、

$V_R - V_L = 4d\alpha x$

となり、観察者の移動距離x と2 つの受光素子の出力差が比例関係にあることが分かる。

【0048】また、従来例の図20で説明した関係で、x=a であるから．観察者の左右方向の移動に立体視領域を追従させるためのレンチキュラ1 の移動量b は．レンチキュラ1 を構成するシリンドリカルレンズの焦点距離をf として、

$b = f(V_R - V_L)/(4d\alpha S)$

となる。

【0049】図7 は実施形態1 の信号の流れを表すブロック図である。これによって実施形態 1 の処理の流れを説明する。図中．30_R と30_L は前で説明した右側受光系と左側受光系である。31_R と31_L は各受光系からの信号を適当な出力まで交流増幅するプリアンプ、32_R と32_L は各プリアンプからの交流信号を整流する整流回路、33_R と33_L は各整流回路で整流された信号を平滑化するローパスフィルタである。

【0050】34は前に説明した赤外光投光系、35は所定の制御信号により赤外LED の発光タイミングと発光強度を制御・駆動するLED ドライバである。36は変調用OSC．であり、投光光を所定の周波数で変調して室内の蛍光灯などの赤外光投光系以外の外乱光の影響を取り除く。この変調用の信号は赤外光投光系とプリアンプ31_R ,31_L に供給・同期することで外乱光の影響を取り除いている。また．この変調周波数は画像表示手段2 の表示周波数の整数倍と異なるように設定し、画像表示からの影響を小さくしている。なお、変調用OSC.36．LED ドライバ35、プリアンプ等は同期手段の一要素を構成している。、37は前に説明した出力V_Rに相当するローパスフィルタ33_R からの信号と出力V_Lに相当するローパスフィルタ33_L からの信号の差を演算する減算器で、この値が観察者の頭部位置を示す。

【0051】38はローパスフィルタ33_R と33_L からの信号の値の和を求める加算器で、この値は観察者に到達している光量の強度を代表する。

【0052】39は所定の光量と加算器38で求めた光量の出力差分を計算するための減算器、40は光量の差分を増幅するための光量エラーアンプである。本実施形態で

は、加算器38の値が常に一定になるように減算器39、光量エラーアンプ40を通しLED ドライバ35にフィードバックを掛ける。これにより図5 の頭部位置x と出力V の関係がほぼいつも同じになり安定した出力が得られるようになる。また、更に、$(V_R-V_L)/(V_R+V_L)$ の演算を行うことにより、一層、安定した出力が得られる。

【００５３】41は減算器37より得られた観察者の頭部位置信号とレンチキュラ1 を可動させるための信号との整合性をとるためのチューニングアンプである。42はスライド機構のフィードバック制御系を成すための減算器、43は減算器42の信号を増幅または積分あるいは微分するためのサーボエラーアンプ、44はサーボエラーアンプ43の信号を電力増幅するためにパワートランジスタなどで構成したパワーアンプ、45は図3 のスライド機構であり、レンチキュラ1 を移動させる。46は図3 の永久磁石14とホール素子15に検知用電子回路を加えたレンチキュラ位置センサであり、レンチキュラ1 の位置を検出する。

【００５４】この様な装置構成において、観察距離S のもとで観察者の頭部位置の移動量xを求め、レンチキュラ1 をb だけ移動させれば、観察者の移動に同期して立体視領域を追従させることができる。

【００５５】本実施形態によれば、観察者の頭部位置を検知するに際して、従来の画像処理による方法に比べ、外乱光の影響を取り除いて簡易な構成でより高速にその位置を検知することが可能である。

【００５６】次に、実施形態2 について説明する。実施形態1 では、赤外光の戻り光の強度を検出し、観察者の移動距離x を求めるため、観察者の反射率の違いや観察距離によって、検出が不安定になることがあった。実施形態2 では、この問題点を解消するものである。

【００５７】実施形態2 においては赤外線を観察者の頭部に投射し、その戻り光を用いて観察者の像をラインセンサに結像させて、その上の観察者頭部の輪郭より観察者の頭部位置を検知し、この頭部位置（観察位置）をもとに、レンチキュラ1 を機械的に左右方向にスライドさせて、立体視領域の追従を行う。なお、実施形態2 のラインセンサは水平方向に複数の画素を配置した電荷結合素子(CCD) を用いる。

【００５８】図8 は本発明の立体ディスプレイ装置の実施形態2 の頭部位置検出センサ300の要部斜視図である。図中、20,21 とB は実施形態1 と同じ赤外発光ダイオード、シリンドリカルレンズ及び絞り手段であり、投光系B1を構成している。50は赤外光を投光して照明した観察者の像を結像させる受光レンズ、51は赤外光以外を遮光する赤外光透過フィルタ、52は受光レンズ50の結像位置に水平に設けたラインセンサであり、読み出し用の回路によりセンサの長手方向の一次元的な受光強度を測光し、電気的な信号に変換する。なお、レンズ50、赤外光透過フィルタ51、ラインセンサ52等は受光系（受光手段）B2の一要素を構成している。

【００５９】図9 は実施形態2 の頭部位置検出センサ300 の検出原理の説明図である。実施形態1 と同様に観察者400 は赤外LED20 とシリンドリカルレンズ21により照明されている。本図には受光系のみを図示している。赤外光投光系により照明された観察者400 の像はレンズ50によりラインセンサ52上に結像される。ラインセンサ52上に結像した観察者の部分は他の部分より輝度が高いため、この部分を検知し重心を計算すれば観察者の頭部位置が得られる。

【００６０】この観察者の頭部位置の検知は、概略以下の手順で行う。

① 観察者頭部に赤外光を投射する。

② 観察者の頭部像を赤外透過フィルタを介して、ラインセンサ上に結像する。

③ ラインセンサのアナログ信号を適正なレベルまで増幅する。

④ 増幅したラインセンサのアナログ信号を、背景ノイズより多少高いレベル（閾値）で比較し、2 値化信号に変換する。ここで、レベルがハイレベルの部分はセンサ（ディスプレイ）に近い部分であるので観察者とみなせる。

⑤ 2 値化したハイレベルの幅を検出し、その幅が最も広い部分を観察者頭部として、そのハイレベルの最大幅の中心位置を求め観察者の頭部位置とする。

⑥ 上記の計算の信頼性を確認し、所定の条件を満たしておれば装置の中に記憶している頭部位置データ（頭部位置情報）の更新をする。又、必要に応じて線形補正を行う。

⑦ 得られた観察者位置データをレンチキュラをスライドさせるサーボ系回路へ送信する。

【００６１】以下、実施形態2 の作用を順を追って説明する。図10は頭部位置検出値とレンチキュラ1 のスライド量の関係の説明図である。そして、図10(A) は頭部位置検出センサ300 の作用説明図、図10(B) はレンチキュラ1 の移動量の説明図である。図中、S_0は観察者から頭部位置検出センサのレンズ50までの距離、400'は移動後の観察者位置、S_0' は移動後の観察者からレンズ50までの距離、f_0はレンズ50の焦点距離、θ_0 は観察者400 とレンズ50の主点を結ぶ直線が基準線（受光系の光軸）とのなす角度、x_0はラインセンサ52が検出する頭部検出位置である。

【００６２】図10(B) において、1_1はレンチキュラ1 を構成する一つのシリンドリカルレンズ、f は該シリンドリカルレンズの焦点距離、S_1とS_1' は画像表示手段から観察者までの距離、b はレンチキュラ1 の移動量、θ_1 は観察者とシリンドリカルレンズ1_1の主点を結ぶ線と基準線とのなす角度である。

【００６３】図10(A) においてレンズ50の被写界深度が十分であれば、観察者400 の位置に関係なく、θ_0 とx_0

の関係は比例関係になる。

【0064】また、図10(B) では観察者400 の距離に関係なくθ₁ とb の関係は比例関係にある。一つの立体ディスプレイ装置の中ではθ₀ とθ₁ は同じ値になるため、頭部位置検出値のx_0とレンチキュラ1 のスライド量b は比例関係にすれば良いので、観察者の距離と無関係に検出値x_0をもとにスライド量b を制御することで、立体視領域の追従が実現できる。

【0065】図11は実施形態2 の全体の構成を示すブロック図である。図中、B1は投光系であり、赤外LED 20とこの赤外光を横方向に長いビーム状の光束に絞るシリンドリカルレンズ21からなり、所定の方法で駆動している。B2は受光系であり、照明された観察者からの戻り光を透過する赤外(IR)フィルタ51と観察者の頭部像を結像させる為の受光レンズ50と結像された像を電気信号に変換するラインセンサ52からなる。

【0066】このラインセンサは電荷結合素子(CCD) であるので、このラインセンサ52を駆動するために、検知マイコンB4からラインセンサの1 走査時間を決定するシフトパルスと、発振器B11 から分周器B12 を介してラインセンサ駆動用のクロック及びデータ読み出し用のクロックが供給され、各画素の輝度信号がアナログ量で出力される。

【0067】B3は2 値化処理系 (2 値化手段) であり、ラインセンサ52より得られたアナログ信号をある増幅率で適当な値まで増幅するアンプB14 と、ある閾値で比較し、ハイレベルまたはローレベルの2 値に変換する比較器B15 からなっている。B4は検知マイコンであり、2 値化処理系B3からの信号を受けて観察者の位置の計算、2 値化信号や計算結果の信頼性チェック、計算データをサーボマイコンB5に送信する等の処理を行う。

【0068】B5はサーボマイコンで、観察者位置データを検知マイコンB4より受信し、これより立体視領域を追従させる為の望ましきレンチキュラ1 の位置を換算し、レンチキュラ位置センサB6からのレンチキュラの位置情報と比較して制御量を計算し、これをスライド駆動系B7のモータドライバB54 に出力する。

【0069】スライド駆動系B7は、図3 で説明したレンチキュラのスライド支持機構とモータや減速ギア等から構成されるスライド機構B55 やモータドライバB54 等を有しており、サーボマイコンB5からの制御信号を受けてレンチキュラの左右位置を制御して観察者位置へ立体視領域を追従させる。

【0070】図11において、発振器B11 は検知用マイコンB4に基本クロックを供給すると共に、同じ基本クロックを分周器B12 に供給して分周して形成するクロックをラインセンサ52に供給している。また、ラインセンサ52の1 走査時間を決めるシフトパルスは検知マイコンB4のソフトウエアによって生成してラインセンサ52へ出力して、これを制御している。ラインセンサ52からのアナログ信号は微弱でありかつ直流バイアス分を含むので、この信号は引き算と増幅を行うアンプB14 によって適当なレベルまで増幅する。この増幅された信号を比較器B15で或る閾値と比較し、2 値化信号として検知マイコンB4に入力され、ここで観察者の頭部位置を検出する。

【0071】また、検知マイコンB4よりDAコンバータB16 に信号を出し、駆動回路B17 を介して赤外LED20 の発光強度を制御し、観察者の照射強度を適切に制御する。

【0072】観察者の位置検知には、図11のブロック図中の投光系B1と受光系B2と2 値化処理系B3及び検知マイコンB4等が関係するが、ここでは主に検知マイコンB4内部のソフトウエア処理について説明する。

【0073】図12は検知マイコンB4内部で実行するプログラムのフローチャートである。これについて説明する。

【0074】ステップS1はマイコンの入出力ポート等の設定をするステップであり、2 値化処理系によって2 値化された信号の入力ポートの設定もここで行う。ステップS2ではラインセンサの1 走査時間と読み出し開始時間を決定するシフトパルスを発生させる。ステップS3は光学的に像を結んでいるラインセンサ上の読み出し位置までの待機をするステップである。ステップS4ではラインセンサ52が出力する観察者を含む対象の明るさ信号を1画素分づつ順次取り込み、その2 値化された出力のハイレベルの幅を順次求め、ハイレベルの最大幅とその位置を求めるステップである。（このステップの処理については別に説明する。）
ステップS5は得られたハイレベルの幅や位置より最大幅の信頼性を検証し、観察者の位置（パルスの中心）を計算するステップである。（このステップの処理については別に説明する。）ステップS6はセンサ出力の非線形部分（両端）を線形補正するステップである。ステップS7は得られた観察者の位置データをサーボマイコンB5を含むサーボ回路へ送信するステップである。ステップS8は今検出したラインセンサ52の出力に基づいて赤外LED20の発光強度を制御するステップである。ステップS9は次に観察者の位置を検出して、これに対応するまでの待機であり、所定時間後に再びステップS2に進み、ステップS2からS9の間で無限ループを構成することになる。

【0075】図13は図12で説明した検知マイコンB4内のステップS4で行う2 値化出力のハイレベルの最大幅を求めるプログラムのフローチャートである。これについて説明する。

【0076】ステップS4a はこのルーチンで使用するレジスタを強制的に0 にクリアするステップである。ここで使用するレジスタは、このループのカウント即ち、ラインセンサ上の読み出し位置（アドレス）を示すCountレジスタと、一時的にハイレベルの幅を格納するWidthレジスタと、ハイレベル幅の最大値を更新・格納するWidthMaxレジスタと、及びWidthMaxの終端のアドレスを格

納するLastAdd レジスタからなっている。本実施形態では、これらのレジスタを8bitを一つの単位として構成している。また、検知スパンはCount レジスタが0 から255を取るように設けている。

【００７７】ステップS4b はラインセンサ52のCount レジスタで指定されるアドレスの画素からの出力を、ステップS1で設定したマイコンの入力ポートより2 値化出力として読み込むステップである。ステップS4c はこの2 値化された出力をローレベルかハイレベルかの判定をするステップである。ステップS4d ではWidth レジスタを+1増やす。ステップS4e は(WidthMax-Width)の演算を行って、その正負を判定するステップであり、この値が負となればステップS4f でWidthMaxレジスタを更新する。ステップS4g はWidthMaxレジスタの終端値(LastAdd レジスタの値) を更新するステップである。

【００７８】ステップS4i はCount レジスタを+1増やすステップである。ステップS4j はCount レジスタがオーバーフロー即ち、255 を越えたかどうかを判定するステップである。

【００７９】ステップS4k は2 値化された出力がローレベルであった場合にWidth レジスタをクリアするステップである。ステップS4h とS4m とS4n は夫々所定の時間を浪費して各ループの処理時間を揃える遅延のステップである。

【００８０】このルーチンの流れとしては、Count レジスタが255 をオーバーフローするまでは、判断ステップS4c とS4e により、以下の3 通りのループに沿ってこのルーチンの中でループを回って処理が進む。また、ステップS4h とS4m とS4n は、この3 つのループの処理時間を同一にするように設けた遅延時間ステップである。

【００８１】① ステップS4b →S4c →S4d →S4e →S4f →S4g →S4h →S4i →S4j からS4b へ戻るループ。このループを順を追って説明する。ステップS4b でラインセンサ52より取り込んだ1 画素の2 値化出力はステップS4c でハイレベルと判断されると、ステップS4d でWidth レジスタの数値を 1増やした後、ステップS4e においてWidth レジスタとWidthMaxレジスタの数値の大小関係を比較する。

【００８２】ここでWidth レジスタの値がWidthMaxレジスタの値よりも大きければ、ステップS4f に進み、現在のWidth レジスタの値をWidthMaxレジスタに格納して、数値を更新する。更に、ステップS4g においてLastAdd レジスタの数値を現在のCount レジスタの値で更新する。次いでステップS4h で経過時間を調整して、ステップS4i へ進む。ステップS4i ではラインセンサ上のアドレスカウントのCount レジスタに+1を加えてひとつ繰り上げる。次いで、ステップS4j でCount レジスタの値が画素数、即ち、今の場合255 をオーバーフローしたか否かを判断し、もしオーバーフローしていなかったらステップS4b に戻って次の画素について上記の処理を行う。

【００８３】なお、Count レジスタの値が画素数をオーバーフローしていたらS4の処理を終わりステップS5へ進む。

【００８４】② ステップS4b →S4c →S4d →S4e →S4n →S4i →S4j からS4b へ戻るループ。ステップS4b →S4c →S4d →S4e までの処理は上記の①と同じである。ステップS4e でWidth レジスタの値がWidthMaxレジスタの値よりも小さければ、ステップS4n へ進み、WidthMaxレジスタとLastAdd レジスタを更新することなく、処理時間の調整を経て、ステップS4i に進む。ステップS4i →S4j からS4b へ戻る処理は上記の①と同じである。

【００８５】③ ステップS4b →S4c →S4k →S4m →S4i →S4j からS4b へ戻るループ。ステップS4c でラインセンサ中の一つの画素（Count レジスタでそのアドレスが指定されている）の2 値化出力がローレベルと判断されると、ステップS4k に進み、ハイレベルの幅を示すWidth レジスタをクリアにし、ステップS4m で処理時間の調整を経て、ステップS4i へ進み、以後、上記のステップS4i →S4j からS4b へ戻る処理を行う。

【００８６】図13に示すステップS4の処理を行うと、ハイレベルの最大幅がWidthMaxレジスタに、WidthMaxレジスタの終端のアドレス位置がLastAdd レジスタに格納される。なお、検知マイコンB等はハイレベルの最大幅を検出する幅検出手段の一要素を構成している。

【００８７】図14は図12中のステップS5の処理のフローチャートである。ここではステップ4 で得たハイレベルの最大幅（WidthMaxレジスタ）と終端のアドレス位置（LastAdd レジスタ）の信頼性を検証して、観察者の位置（頭部位置情報）を計算し、その位置をPosObs レジスタに格納する。なお、図中の$Width_H$ はWidthMaxの上限値、$Width_L$ はWidthMaxの下限値である。

【００８８】図14において、ステップS5a はハイレベルの最大幅の始端がラインセンサ上の始端（検知範囲の最小値）と一致するか否かを判定するものである。ここではWidthMax-(LastAdd+1)が0 になるかどうかをチェックし、もし0 になれば、ハイレベルパルスの最大幅がラインセンサ52の始点で制限（欠けている）されているので、この得られた値は信頼性がないと判断して、観察者の位置の計算・更新をすることなく次のステップS6に進む。もし0 でなければ、ステップS5b へ進む。

【００８９】ステップS5b はハイレベルの最大幅の終端がラインセンサ上の終端（検知範囲の最大値）と一致するか否かを判定するものである。ここではLastAdd+1 が0 になるかどうかをチェックする。もし、0 になれば、ハイレベルの最大幅の終端がラインセンサ上の終端と一致しており、ハイレベルパルスの最大幅がラインセンサの終点で制限（欠けている）されているので、この得られた値は信頼性がないと判断して、観察者の位置の計算・更新をすることなく次のステップS6に進む。もし、0 でなければ、ステップS5c へ進む。

【0090】ステップS5c はWidthMaxレジスタの値が上限値のWidth$_H$ を越えるかどうかチェックするステップで、上限値を超えるようであれば、観察者の位置の計算・更新をすることなく次のステップS6に進む。上限値を越えなければ、ステップS5dに進む。

【0091】ここで上限値のWidth$_H$ は本実施形態の追従可能範囲において、観察者の頭部が最も近いときの幅と多少のマージンを加えた幅に相当する値を予め設定している。

【0092】ステップS5d はWidthMaxレジスタの値が下限値のWidth$_L$ より小さいかどうかをチェックするステップで、下限値を下まわるようであれば、観察者の位置の計算・更新をすることなく次のステップS6に進む。下限値を越えなければ、ステップS5e に進む。

【0093】ここで下限値のWidth$_L$ は本実施形態の追従可能範囲において、観察者の頭部が最も遠いときの幅と多少のマージンを引いた幅に相当する値を予め設定している。ステップS5c 及びステップS5d はハイレベルの最大幅が所定幅以内か否かを判断するステップである。

【0094】ステップS5e はハイレベルの中心位置を求めるステップであり、LastAdd-WidthMax/2の演算によって求められ、その結果を観察者の位置として、PosObsに格納する。以上がステップS5の処理である。なお、検知マイコンB4等は判断手段の一要素を構成している。

【0095】前記のようにラインセンサから52の出力信号は2 値化処理系B3において所定の閾値でハイレベルまたはローレベルの2 値化信号に変換する。しかしながら、観察者の奥行き方向の距離が異なればラインセンサの出力値が異なる。即ち、観察者が遠いとラインセンサ52の出力が小さくなって、所定の閾値を下まわり、正確な2 値化信号が得られなくなることがある。

【0096】このため、ラインセンサ52の出力が小さい場合には、赤外LED20 の発光強度を上げて、ラインセンサ52の出力を上げる必要がある。本実施形態では、検知マイコンB4がラインセンサの出力の積分値（総和）又は最大出力値を調べ、これが一定になるようにADコンバータB16 及び駆動回路B17 を介して赤外 LED20の発光強度を制御し、安定した2 値化処理ができるようにしてある。

【0097】なおこの他に、ラインセンサ52の出力信号のアンプB14 のゲインをコントロールする、或は2 値化処理の閾値を変化させる、或はこれらの2 値化安定の手段を複数組み合わせることででも同様に安定した2 値化処理が行える。

【0098】次に、本実施形態のレンチキュラ1 の位置をサーボ系回路によって制御する作用を図11によって説明する。サーボ系回路は図11のサーボマイコンB5により制御する。このサーボマイコンB5は検知マイコンB4から観察者位置データを受け取り、これから観察者の位置に対応して立体視領域を形成する望ましきレンチキュラ1 の位置を換算して求める。レンチキュラ1 の現在位置はポテンショメータ若しくはホール素子等のレンチキュラ位置センサB6により、電圧に変換され、その電圧値はサーボマイコンB5に内蔵したADコンバータによってディジタル値に変換され、望ましきレンチキュラ1 の位置との差分を計算し、レンチキュラ1 の制御量をモータドライバB54 に出力する。モータドライバB54 はスライド機構B55 を駆動してレンチキュラ1 を望ましき位置に移動させ、立体視領域を観察者の位置に追従させる。なお、この動作の際、発振器B51 からサーボマイコンB5にクロックを供給してタイミングを取る。

【0099】このようにサーボマイコンB5→モータドライバB54 →スライド機構B55 →レンチキュラ1 →レンチキュラ位置センサB6→サーボマイコンB5と一つのループをなすことで、レンチキュラ1 の移動制御を行っている。

【0100】図15はサーボマイコンB5内部で実行するプログラムのフローチャートである。ステップS51 はマイコンの入出力ポート等の設定をするステップであり、検知マイコンB4から観察位置の入力ポートの設定もここで行う。

【0101】ステップS52 はレンチキュラ1 の位置データの入力ステップであり、レンチキュラ位置センサB6から出力されるレンチキュラ1 の位置信号をサーボマイコンB5に内蔵しているADコンバータに入力し、ディジタル値としてのレンチキュラ1 の位置データを得る。

【0102】ステップS53 はの望ましきレンチキュラの位置の入力ステップであり、検知マイコンB4から観察者の位置データを入力して望ましきレンチキュラ1 の位置データに換算するステップである。

【0103】ステップS54 は、得られた望ましきレンチキュラ1 の位置データと現在のレンチキュラ1 の位置データの差分をとり、必要に応じて比例要素(P動作) や積分要素(I動作) や微分要素(D動作) の特性を負荷するPID の計算ステップであり、必要とする制御量を計算する。

【0104】ステップS55 はPWM の出力のステップであり、ステップS54 で得られた制御量に基づき、モータに印加する電圧のパルスのデューティを変化してレンチキュラ1 を移動させる。このステップS55 が終わるとステップS52 に戻り無限ループをなす。

【0105】実施形態2 は観察者の頭部に赤外光を変調して投光し、その反射光をラインセンサの受光手段で検知し、その出力を適切に処理して、観察者の頭部位置を検出しているが、その際水平方向のみに感度分布のあるラインセンサを用いたので観察者の上下方向の画像処理が省略出来、演算量を少なくして、簡易な構造で高速に立体視領域を追従させることが出来る。

【0106】なお、以上の各実施形態はレンチキュラレンズ方式の立体ディスプレイ装置であったが、パララッ

クス・バリヤ方式等の偏向光学素子を用いて両眼視差画像を表示する立体ディスプレイ装置においても、基本的に以上の実施形態と同じ構成で観察者の頭部位置を検出し、該観察者の頭部位置に基づいて該パララックス・バリヤ等を移動して立体視領域を移動させせることが可能である。

【０１０７】

【発明の効果】本発明は以上の構成により、観察者の頭部に赤外光を変調して投光し、その反射光を複数の受光手段で検知する、又はラインセンサの受光手段で反射光を検知し、その出力を適切に処理して、観察者の頭部位置を検出することにより、簡易な構造でありながら、高速に立体視領域を追従させることが可能な立体ディスプレイ装置を達成する。

【図面の簡単な説明】

【図１】　本発明の立体ディスプレイ装置の実施形態1の外観図

【図２】　実施形態1 のシステムのブロック図

【図３】　実施形態1 のスライド機構の説明図

【図４】　実施形態1 の頭部位置検出センサの要部斜視図

【図５】　実施形態1 の頭部位置検出センサの検出原理の説明図

【図６】　実施形態1 において実験的に求めたホトトランジスタの出力図

【図７】　実施形態1 の信号の流れを表すブロック図

【図８】　本発明の立体ディスプレイ装置の実施形態2の頭部位置検出センサ300 の要部斜視図

【図９】　実施形態2 の頭部位置検出センサ300 の検出原理の説明図

【図１０】　実施形態2 の頭部位置検出値とレンチキュラのスライド量の関係の説明図

【図１１】　実施形態2 の全体構成のブロック図

【図１２】　検知マイコン内部で実行するプログラムのフローチャート

【図１３】　ステップS4で2 値化出力のハイレベルの最大幅を求めるプログラムのフローチャート

【図１４】　ステップS5で信頼性を検証するプログラムのフローチャート

【図１５】　サーボマイコン内部で実行するプログラムのフローチャート

【図１６】　従来のレンチキュラレンズ方式の説明図

【図１７】　特開平3-119889号公報の立体画像表示装置の要部概略図

【図１８】　特開平3-119889号公報の立体画像表示装置の表示部の要部概略図

【図１９】　従来の2 次元画像と3 次元画像を混在表示する立体画像表示装置の説明図。

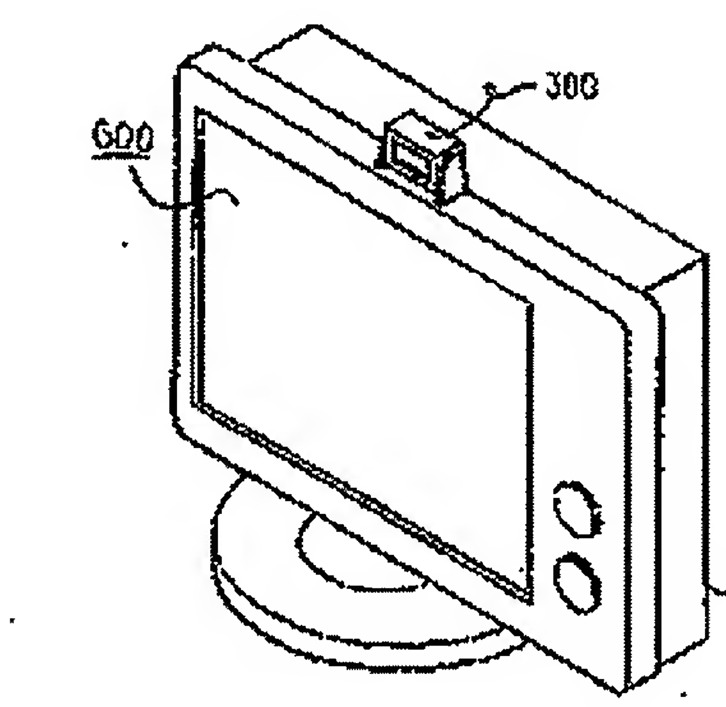
【図２０】　従来のレンチキュラレンズ方式において左右方向に観察者を追従する原理の説明図

【符号の説明】

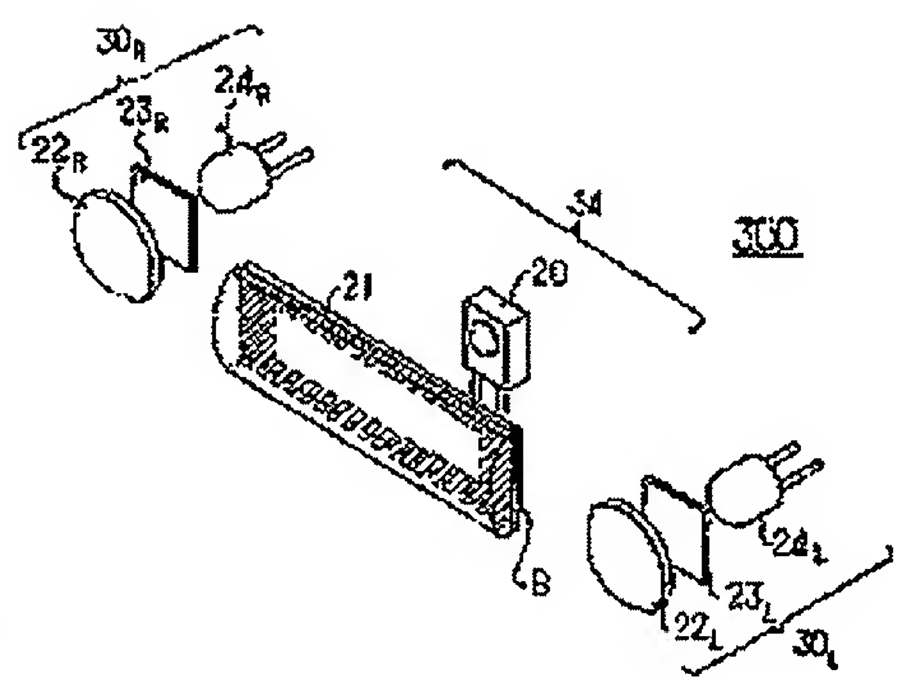
1　レンチキュラレンズ
2　画像表示手段
3　頭部位置検出回路
4　コントローラ
5　スライド機構部
6　スライド駆動回路
10　平行板バネ
11　レバー
12　直流モータ
13　歯車
14　永久磁石
15　ホール素子
20　赤外発光ダイオード（赤外LED）
21　シリンドリカルレンズ
22　コンデンサレンズ
23　赤外光透過フィルタ
24　ホトトランジスタ
30　受光系
31　プリアンプ
32　整流回路
33　ローパスフィルタ
34　赤外光投光系
35　LED ドライバ
36　変調用OSC.
37　減算器
38　加算器
39　減算器
40　光量エラーアンプ
41　チューニングアンプ
42　減算器
43　サーボエラーアンプ
44　パワーアンプ
45　スライド機構
46　スライド位置検知部
50　受光レンズ
51　赤外光透過フィルタ
52　ラインセンサ
101　画像表示面
102　スペーサー
103　電子パララックス・バリヤ
104　マイクロコンピュータ
B　絞り
B1 投光系
B2 受光系
B3 2 値化処理系
B4 検知マイコン
B5 サーボマイコン
B6 レンチキュラ位置センサ
B11 発振器
B12 分周器
B14 アンプ
B15 比較器
B16 DAコンバータ
B17 駆動回路
B51 発振器
B54 モータドライバ
B55 スライド機構

115,125 液晶層
111,118,121,128 偏光板
151 液晶ディスプレイ
152,154 ガラス基板
153 表示画素部
155 レンチキュラレンズ
156 立体視領域
＊300 頭部位置検出センサ
400 観察者
401 シリンドリカルレンズ
402 表示画像部
500 本装置全体
600 立体画像表示部 ＊

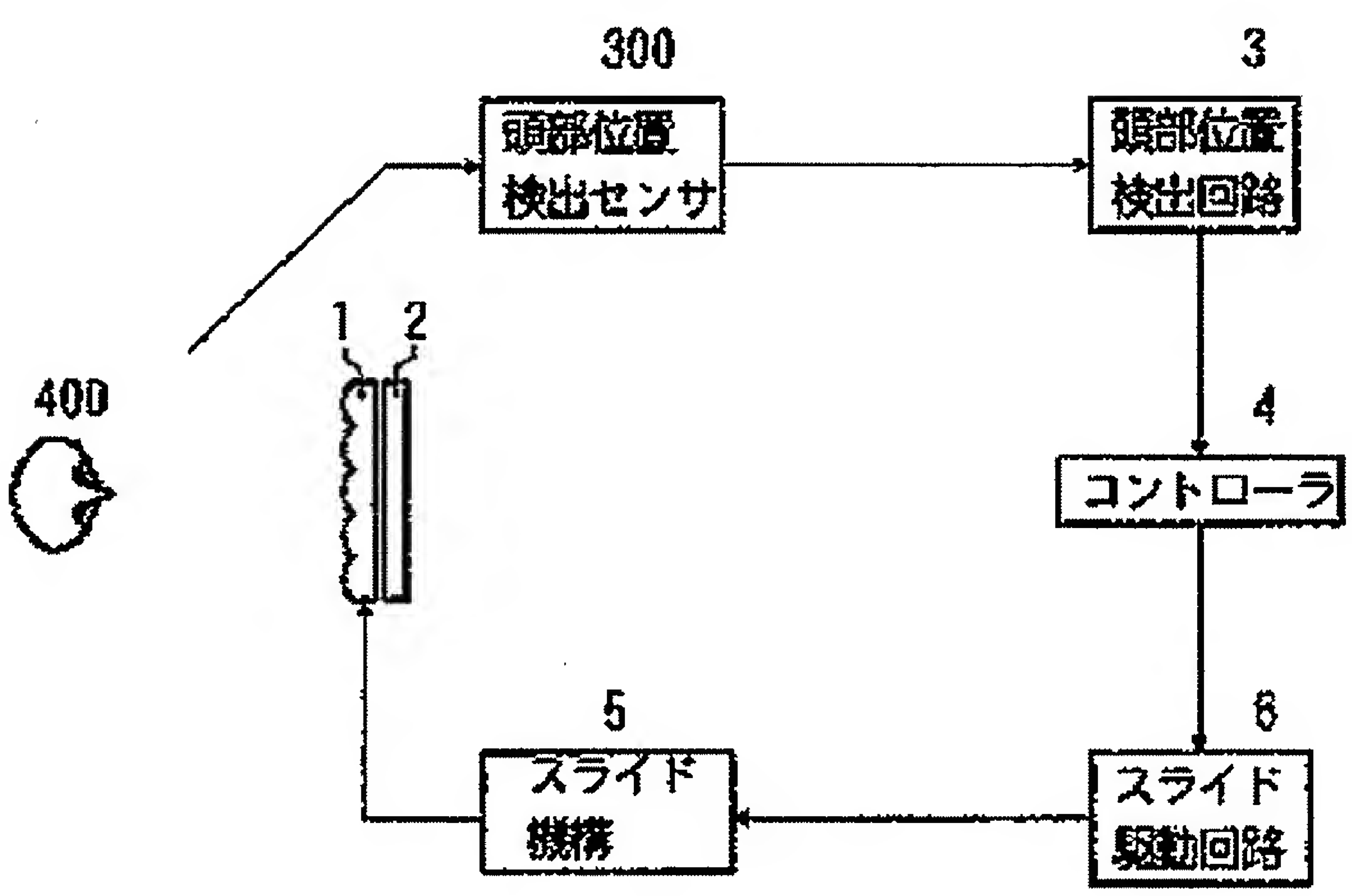
【図1】



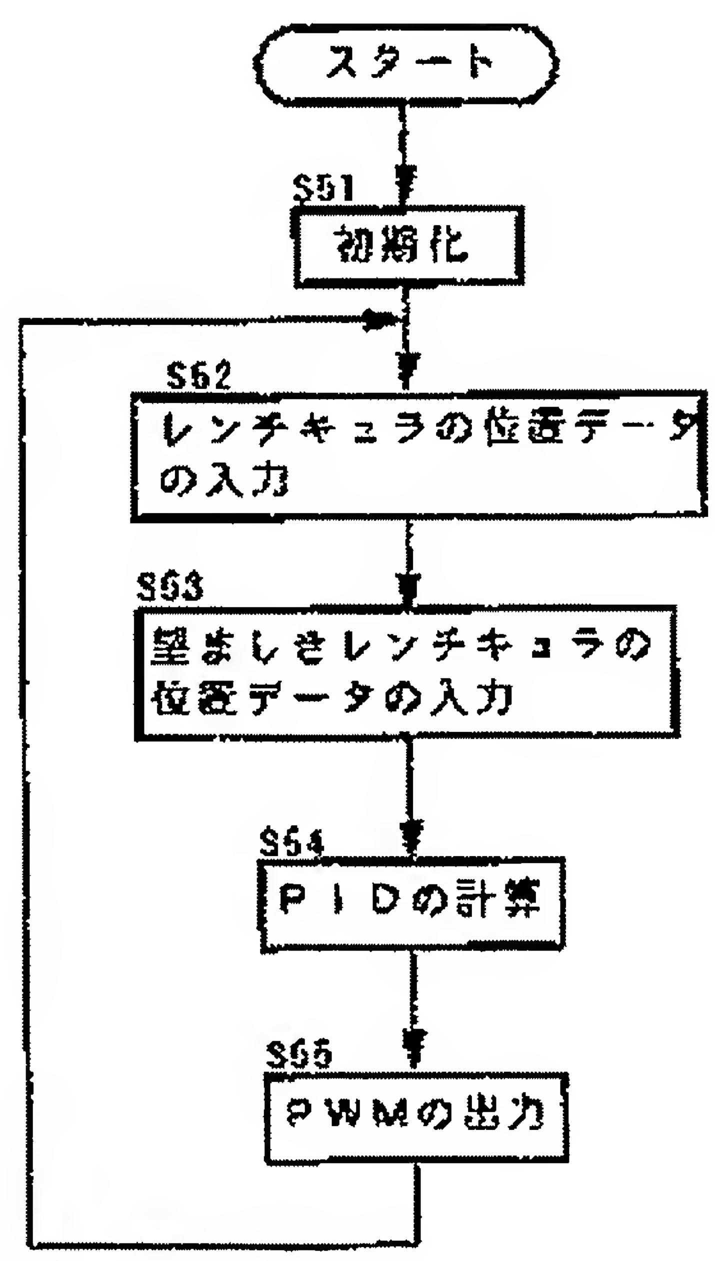
【図4】



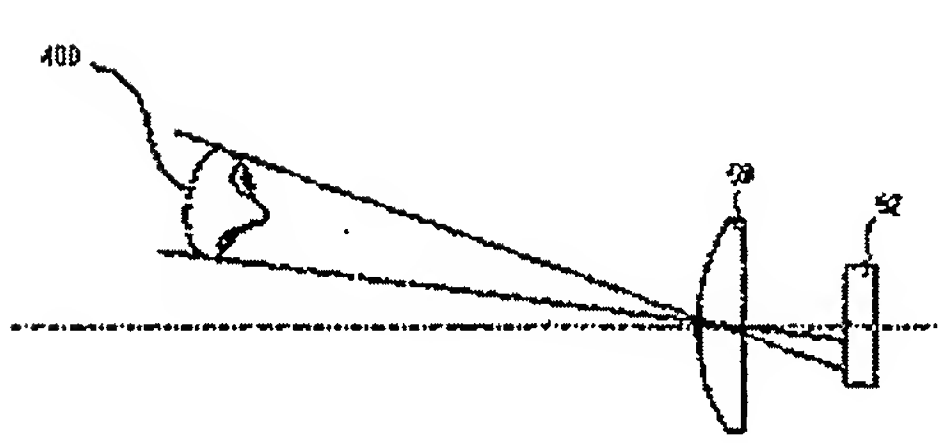
【図2】



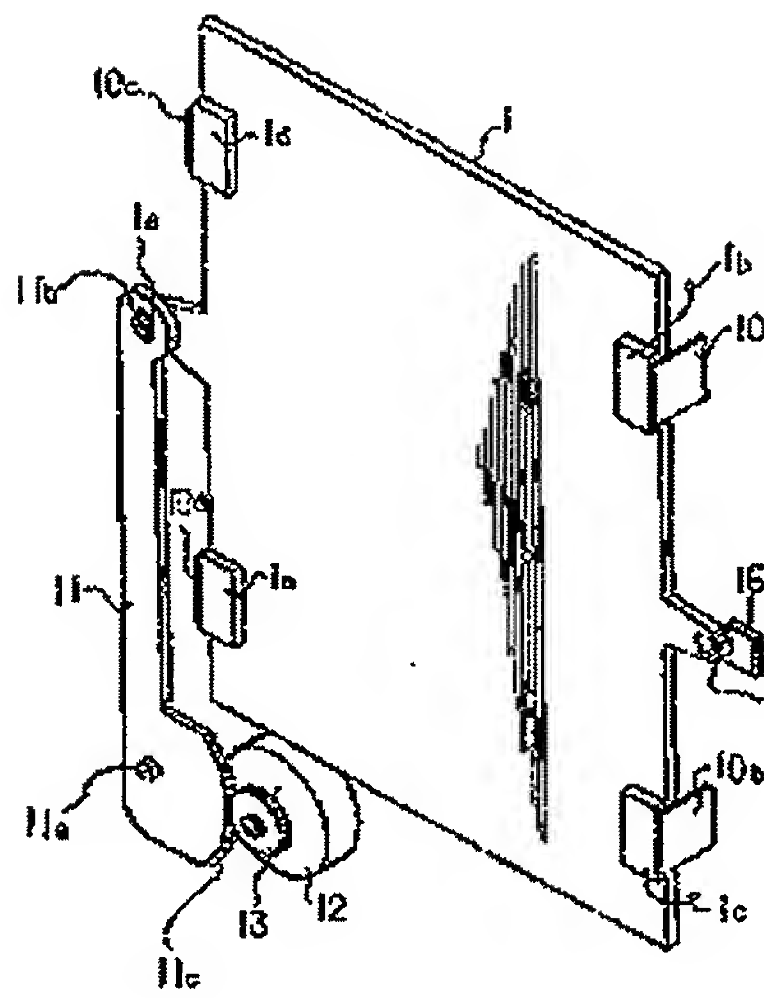
【図15】



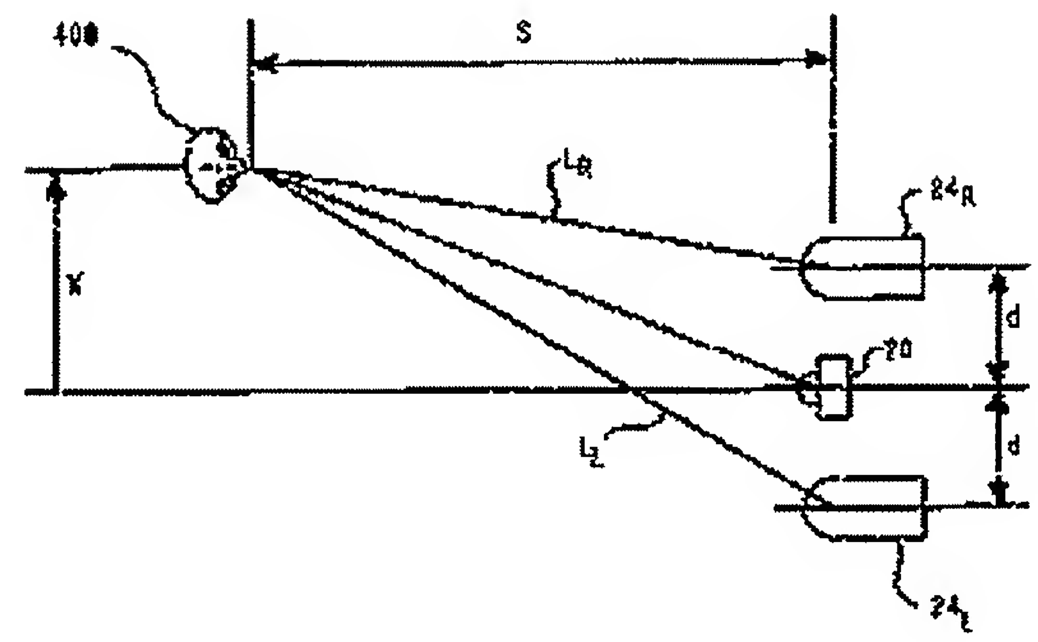
【図9】



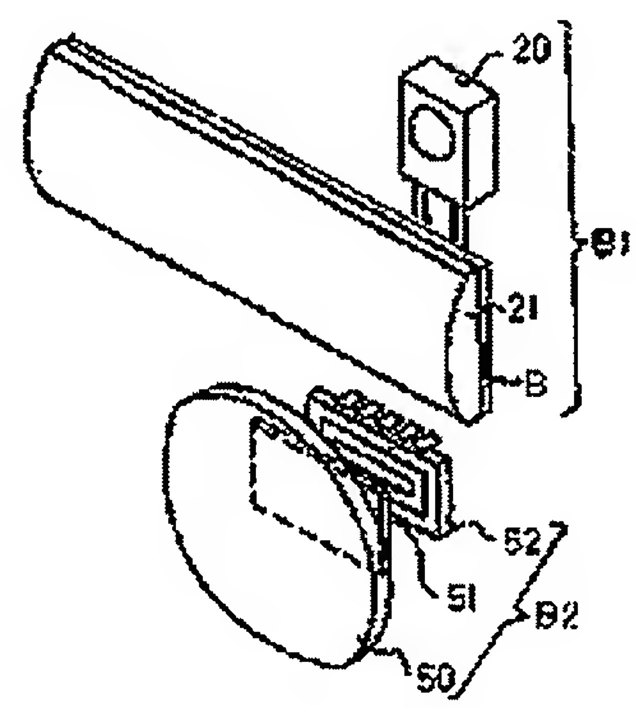
【図３】



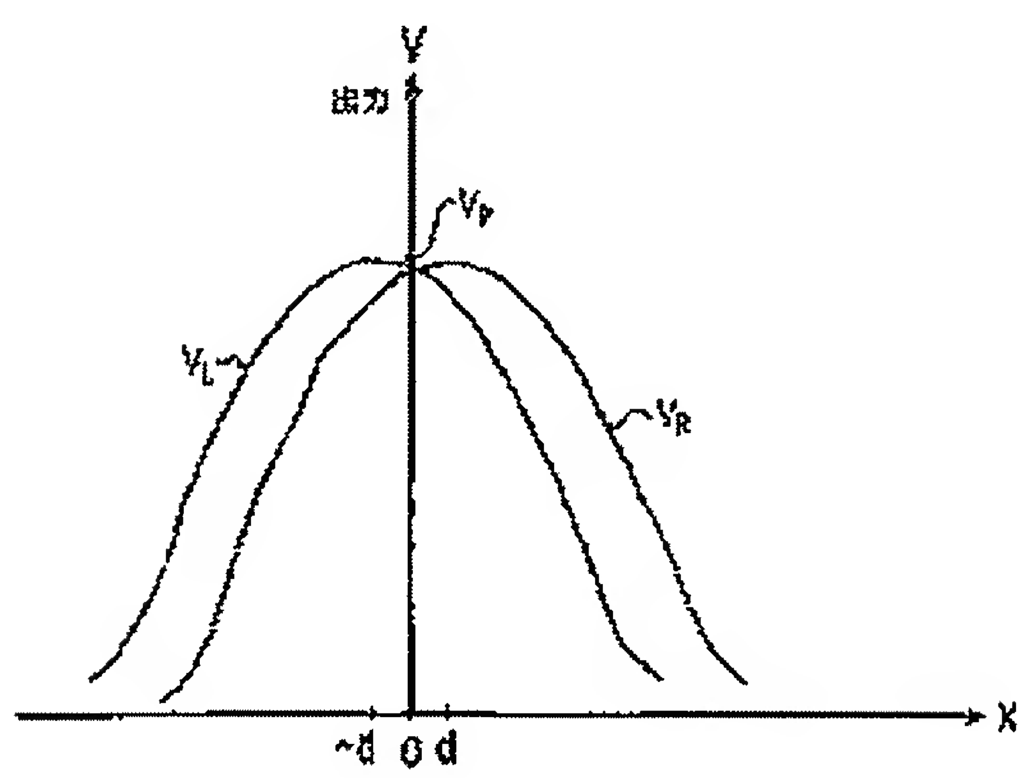
【図５】



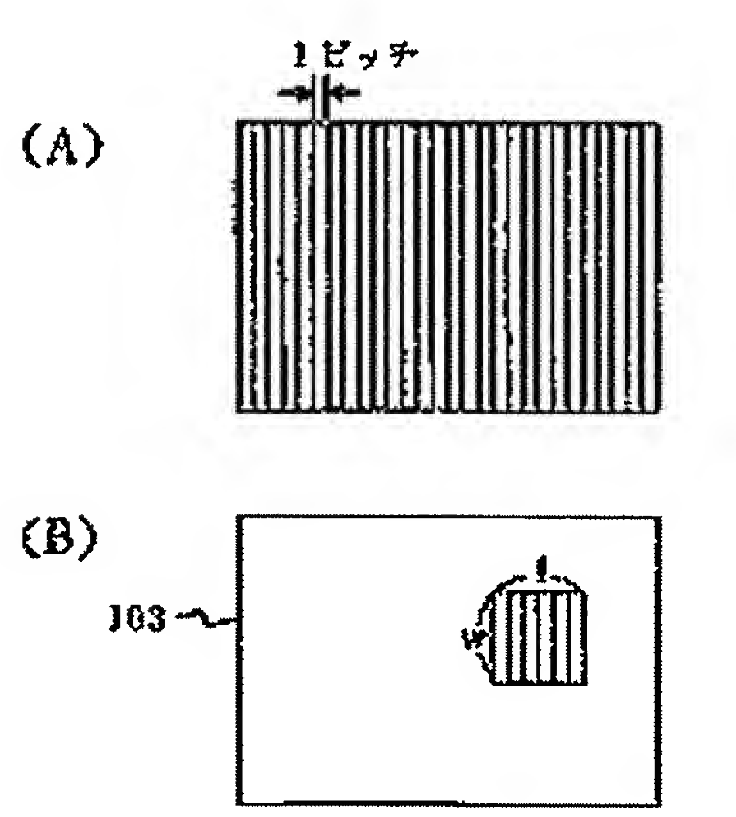
【図８】



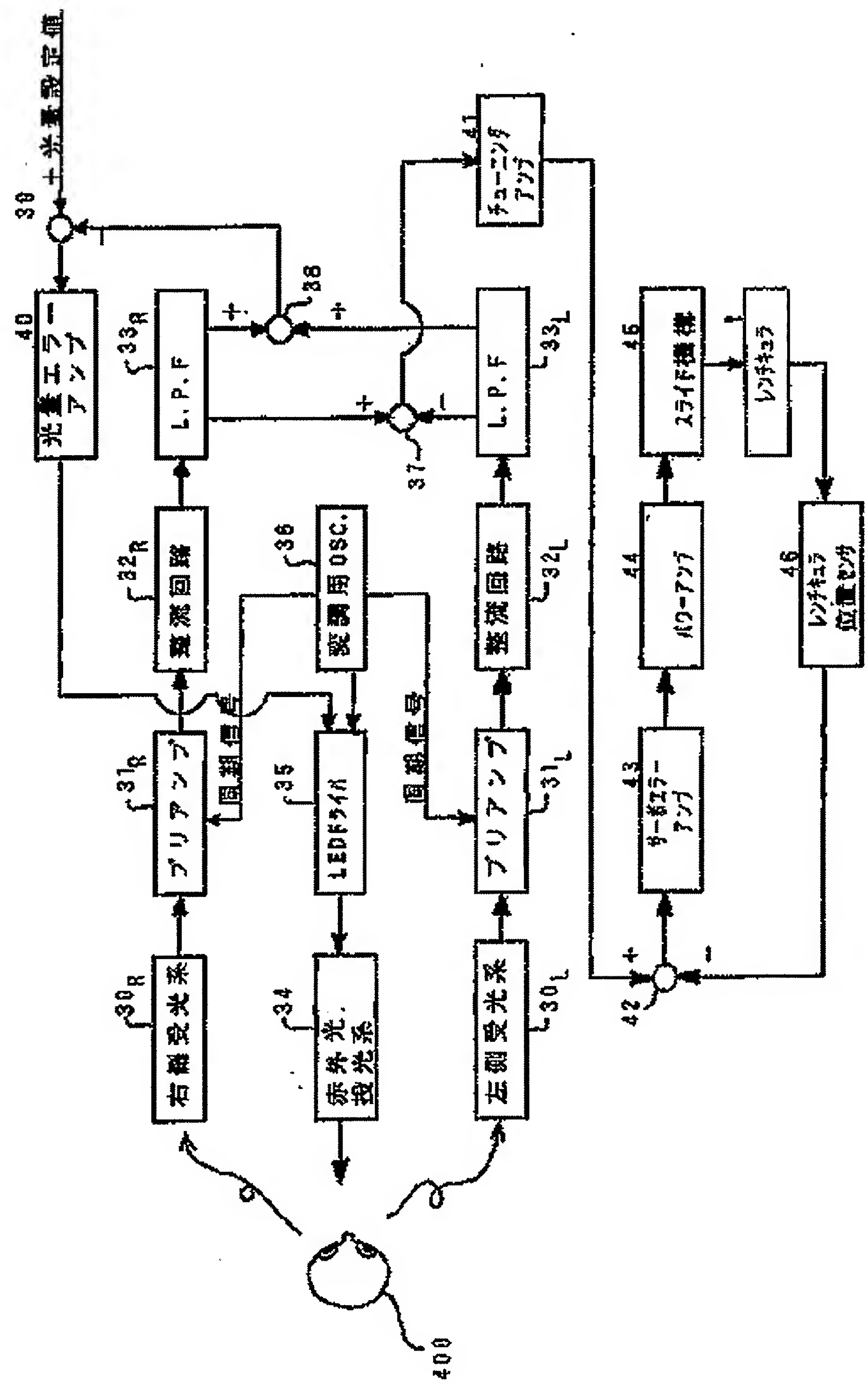
【図６】



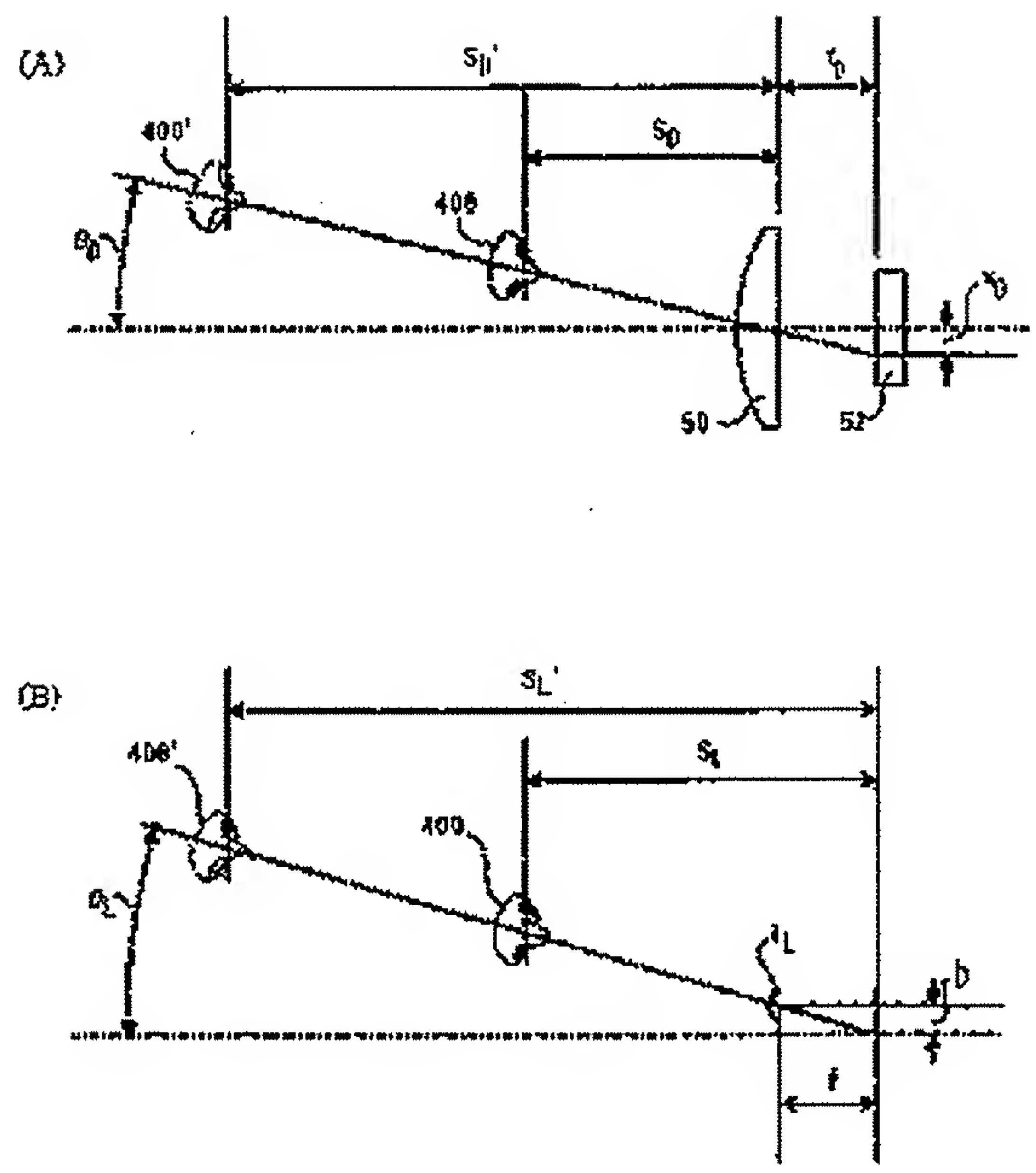
【図１９】



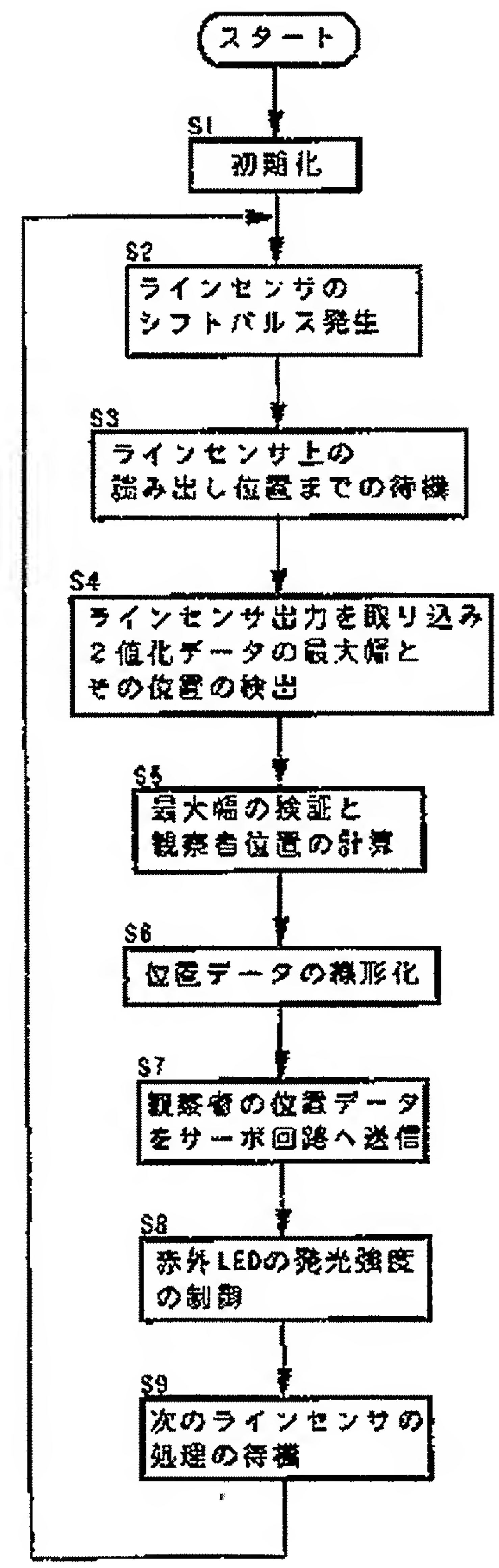
【図７】


光量設定値
39
40
光量エラーアンプ
33R
L.P.F
38
37
41
チューニングアンプ
33L
L.P.F
45
スライド機構
レンチキュラ
32R
整流回路
36
変調用OSC.
32L
整流回路
44
パワーアンプ
46
レンチキュラ位置センサ
31R
プリアンプ
同期信号
35
LEDドライバ
同期信号
31L
プリアンプ
43
サーボエラーアンプ
30R
右側受光系
34
赤外光投光系
30L
左側受光系
42
400

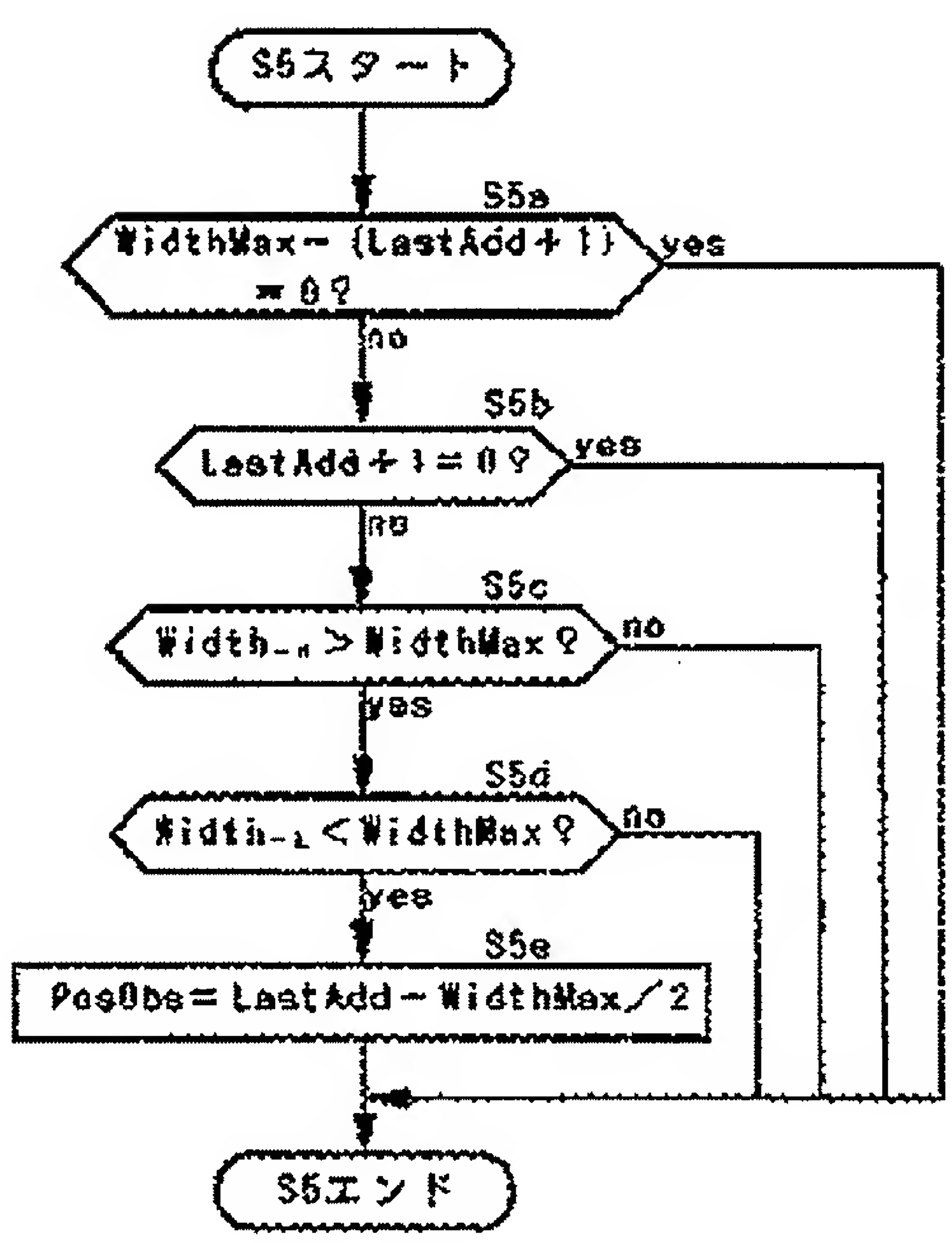
【図10】


(A)
400'
400
50
52
(B)
400'
400

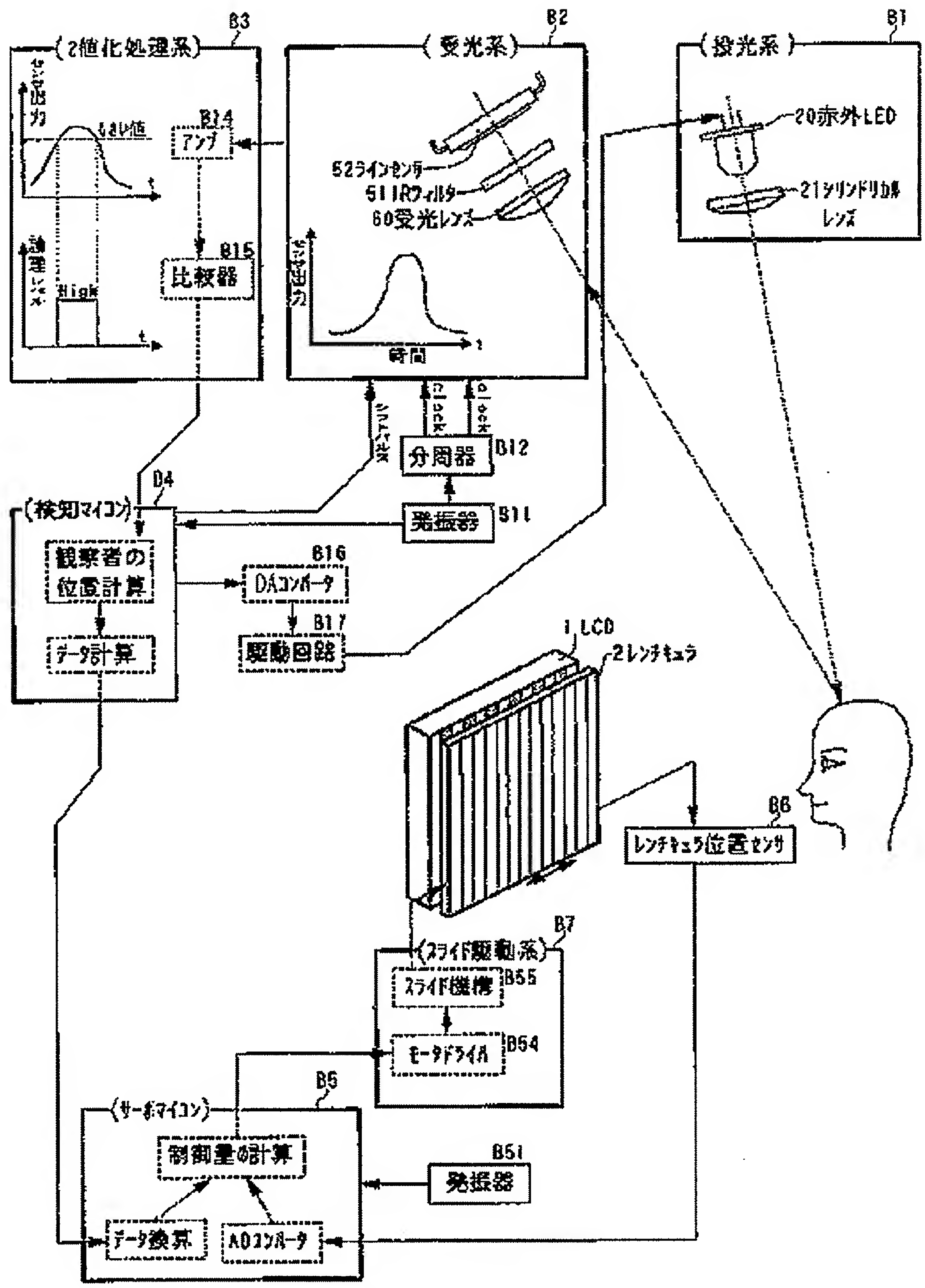
【図12】


スタート
S1
初期化
S2
ラインセンサの
シフトパルス発生
S3
ラインセンサ上の
読み出し位置までの待機
S4
ラインセンサ出力を取り込み
2値化データの最大幅と
その位置の検出
S5
最大幅の検証と
観察者位置の計算
S6
位置データの線形化
S7
観察者の位置データ
をサーボ回路へ送信
S8
赤外LEDの発光強度
の制御
S9
次のラインセンサの
処理の待機

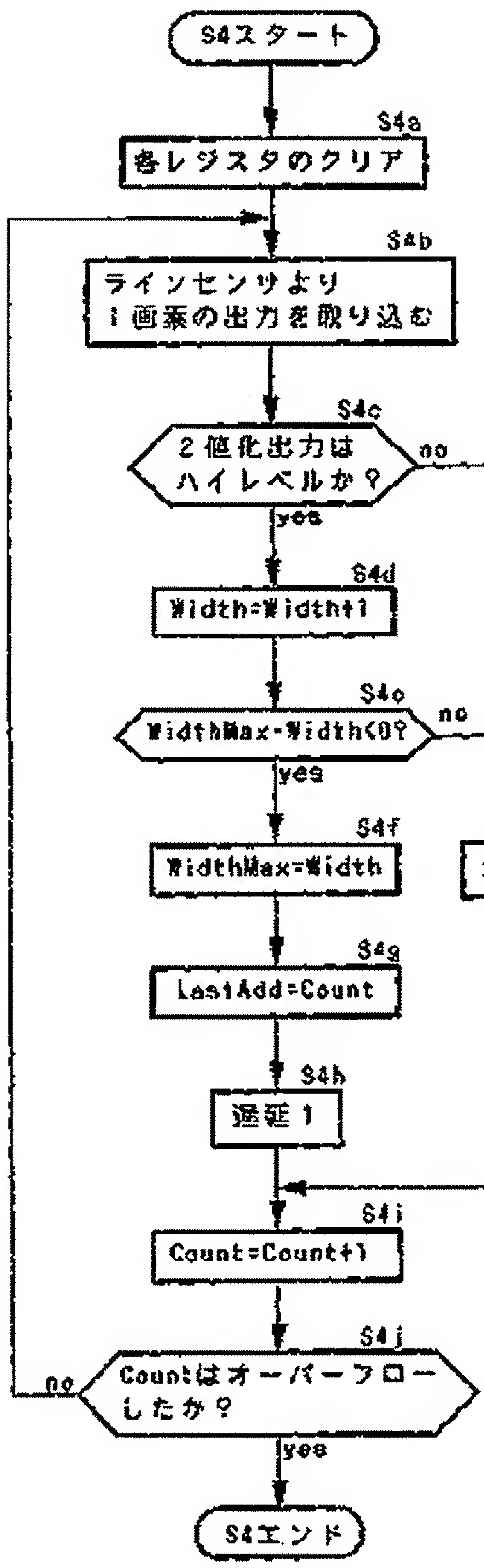
【図14】


S5スタート
S5a
WidthMax－(LastAdd＋1)
＝0？
yes
no
S5b
LastAdd＋1＝0？
yes
no
S5c
Width₋ₙ＞WidthMax？
no
yes
S5d
Width₋₁＜WidthMax？
no
yes
S5e
PosObs＝LastAdd－WidthMax／2
S5エンド

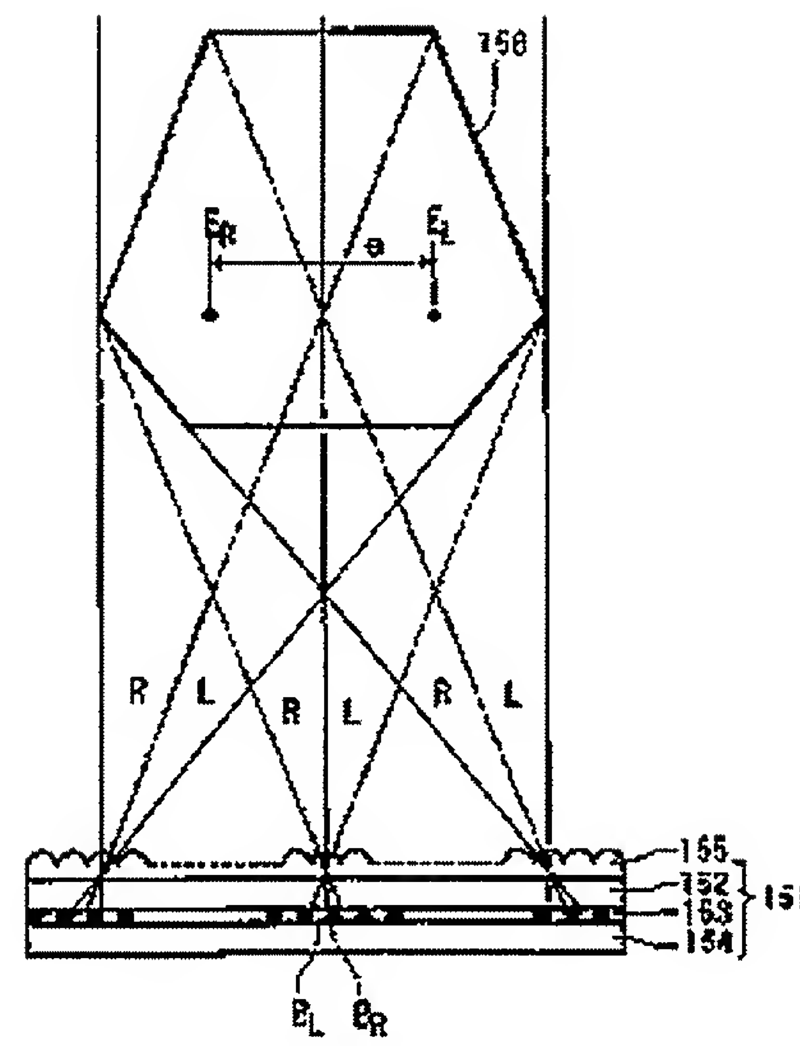
【図11】


B3
(2値化処理系)
センサ出力
しきい値
B14
アンプ
B15
比較器
論理レベル
High
B2
(受光系)
52ラインセンサー
51 IRフィルター
60受光レンズ
センサ出力
時間
B1
(投光系)
20赤外LED
21シリンドリカルレンズ
分周器
B12
発振器
B11
B4
(検知マイコン)
観察者の位置計算
データ計算
B16
DAコンバータ
B17
駆動回路
1 LCD
2レンチキュラ
B6
レンチキュラ位置センサ
B7
(スライド駆動系)
スライド機構
B55
モータドライバ
B54
B5
(サーボマイコン)
制御量の計算
データ換算
ADコンバータ
B51
発振器

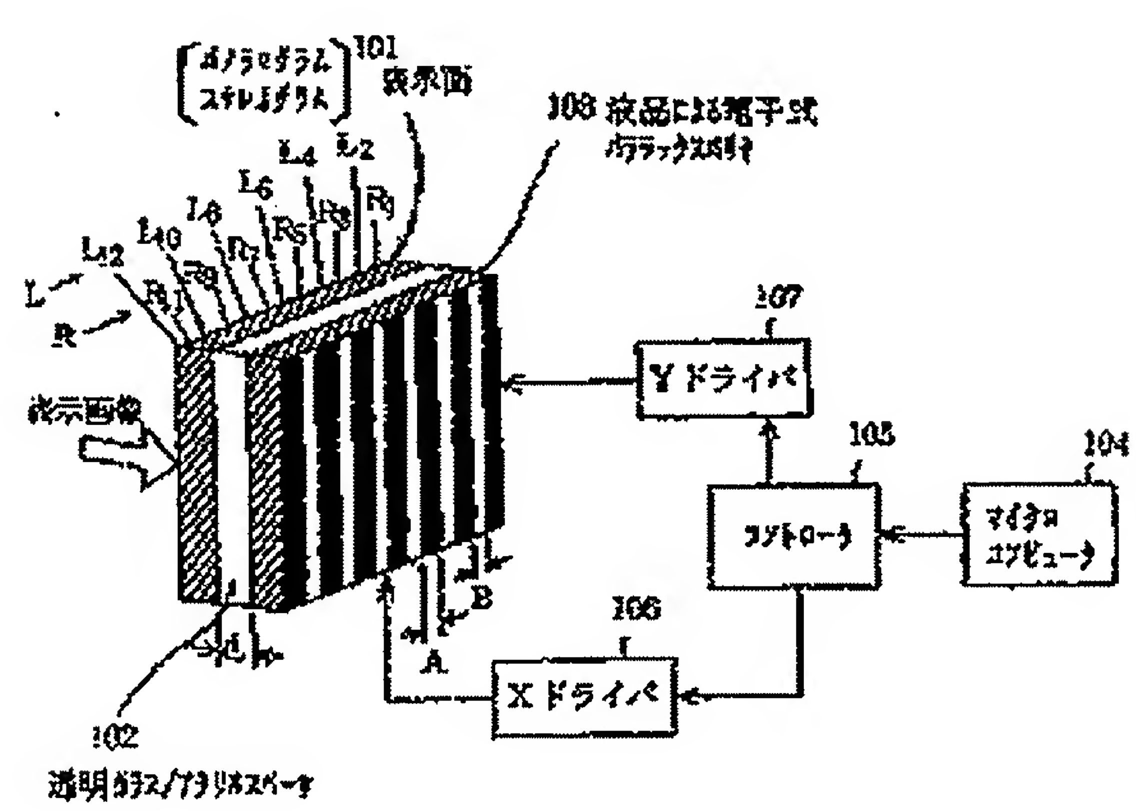
【図13】


S4スタート
S4a
各レジスタのクリア
S4b
ラインセンサより
1画素の出力を取り込む
S4c
2値化出力は
ハイレベルか？
no
yes
S4d
Width=Width+1
S4k
Width=0
S4e
WidthMax-Width<0?
no
yes
S4m
遅延3
S4f
WidthMax=Width
S4n
遅延2
S4g
LastAdd=Count
S4h
遅延1
S4i
Count=Count+1
S4j
Countはオーバーフローしたか？
no
yes
S4エンド

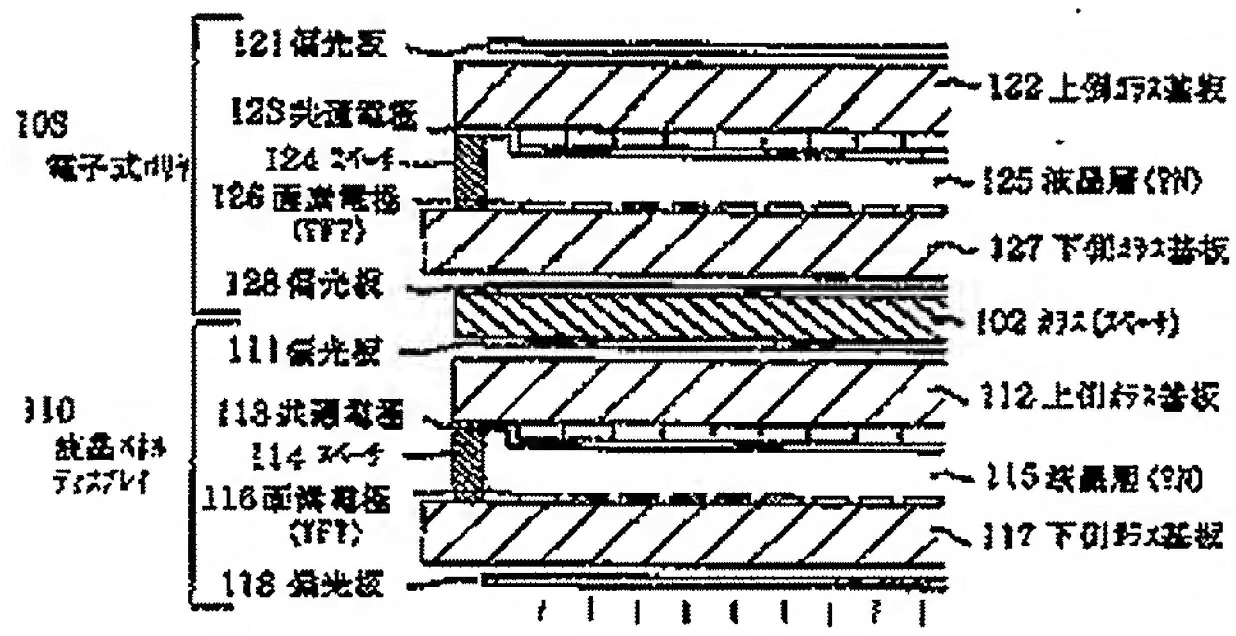
【図16】


156
e
R
L
R
L
R
L
155
152
153
154
151

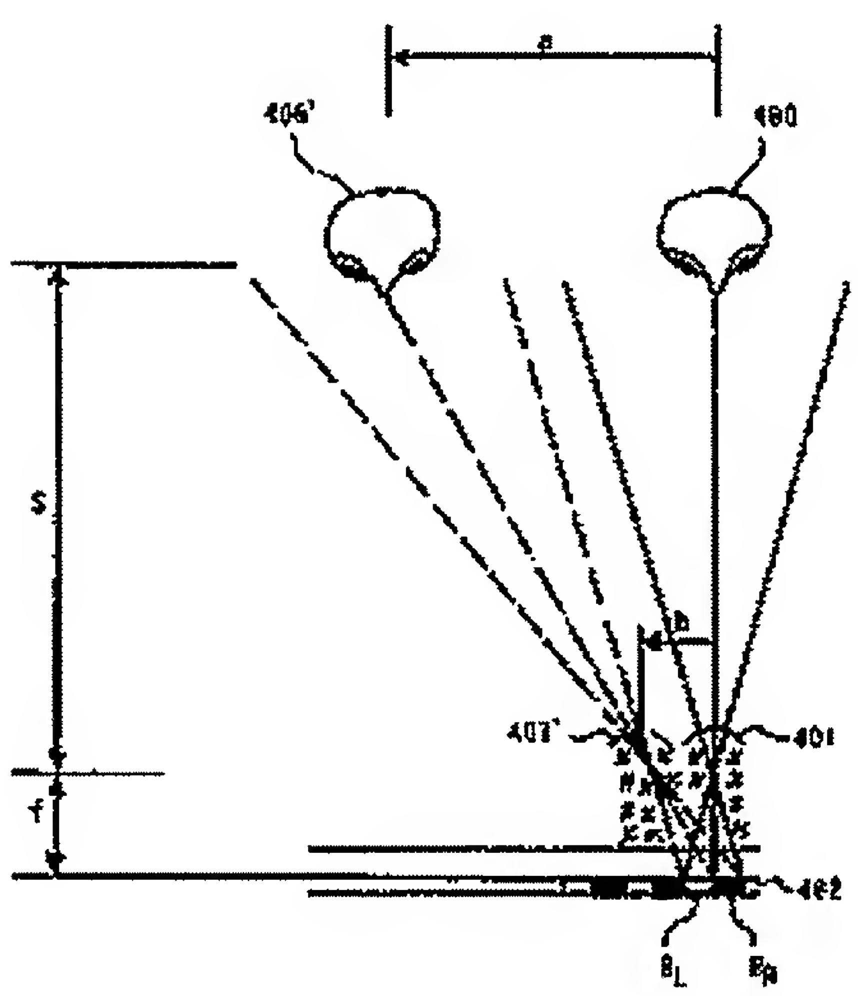
【図17】


101
表示面
103 液晶による電子式パララックスバリヤ
L
R
表示画像
Yドライバ
107
コントローラ
105
マイクロコンピュータ
104
Xドライバ
106
A
B
d
102
透明ガラス/アクリルスペーサ

【図１８】


121 偏光板
122 上側ガラス基板
123 共通電極
124 スペーサ
125 液晶層(TN)
126 画素電極 (TFT)
127 下側ガラス基板
128 偏光板
102 ガラス(スペーサ)
108 電子式バリア
110 液晶パネルディスプレイ
111 偏光板
112 上側ガラス基板
113 共通電極
114 スペーサ
115 液晶層(TN)
116 画素電極 (TFT)
117 下側ガラス基板
118 偏光板
照明光(バックライト)

【図２０】


e
406'
400
s
h
403'
401
f
402
E_L
E_R

CLAIMS

[Claim(s)]
[Claim 1] The parallax image for right eyes and the parallax image for left eyes are divided into a stripe-like stripe pixel, respectively. The stripe image which puts these stripe pixels in order in predetermined sequence, and constitutes them is displayed on an image display means. In the solid display unit which a binocular parallax image is displayed [display unit] for the flux of light from this stripe image by the lenticular lens, a parallax barrier, etc., and a predetermined stereoscopic vision field is formed [display unit], and makes an observer observe a stereoscopic model It has the head location detection means equipped with an infrared light floodlighting means to irradiate by the infrared light which modulated this observer, and a light-receiving means to receive alternatively the modulated this infrared light which this observer reflects. The solid display unit characterized by the means to which a stereoscopic vision field is moved based on this observer's head location which this head location detection means detects making this stereoscopic vision field follow.
[Claim 2] A means to make said stereoscopic vision field follow is the solid display unit of claim 1 characterized by moving said lenticular lens or said parallax barrier based on said observer's head location, and moving said stereoscopic vision field.
[Claim 3] Said infrared light floodlighting means is claim 1 or the solid display unit of 2 characterized by having a diaphragm means to restrict the floodlighting range of the vertical direction.
[Claim 4] Said infrared light floodlighting means or an infrared light light-receiving means is the solid display unit of claim 3 characterized by having the adjustment device in which the direction of radiation or the light-receiving direction of said infrared light can be adjusted in a vertical plane.
[Claim 5] It is a solid display unit given in any 1 term of claims 1-4 which said infrared light floodlighting means modulates the infrared light which this irradiates on a predetermined frequency, and are characterized by said light-receiving means receiving the infrared light which said observer reflects with a synchronous means synchronizing with this modulation.
[Claim 6] The solid display unit of claim 5 characterized by having set up the modulation frequency of said infrared light floodlighting means so that it may differ from the integral multiple of the display frequency of said image display means.
[Claim 7] A solid display unit given in any 1 term of claims 1-6 characterized by controlling the luminescence reinforcement of said infrared light luminescence means so that the amount of the infrared light which this light-receiving means receives becomes fixed, in case the infrared light which said observer reflects is received with said light-receiving means.
[Claim 8] said head location detection means -- 2 said light-receiving means of ** -- horizontal -- detaching -- having -- this -- 2 from the difference of the output of the light-receiving means of ** -- this -- difference -- this -- 2 Solid display unit given in any 1 term of claims 1-7 characterized by detecting said observer's head location from the value which **(ed) by the output sum of the light-receiving means of **.
[Claim 9] Said light-receiving means is a solid display unit given in any 1 term of claims 1-7 which are the line sensors which have arranged two or more pixels horizontally, are made to carry out image formation of said observer's image on this line sensor, and are characterized by detecting this observer's head location based on the center-of-gravity location of this image detected from the signal from this line sensor.
[Claim 10] the signal from each pixel of said line sensor -- 2 a value-ized means -- a predetermined threshold -- 2 of high level or a low level a value -- changing -- this -- 2 Solid display unit of claim 9 characterized by for a width-of-face detection means detecting the high-level maximum width of the value-ized signal, and making the center position into said observer's head location.

[Claim 11] Claim 9 or 10 solid display units which are characterized by controlling the luminescence reinforcement of said infrared light floodlighting means according to the maximum or the integral value of a signal from each pixel of said line sensor.
[Claim 12] A solid display unit given in any 1 term of claims 9-11 characterized by controlling the amplification factor of the signal from this line sensor according to the maximum or the integral value of a signal from each pixel of said line sensor.
[Claim 13] A solid display unit given in any 1 term of claims 9-12 characterized by controlling said threshold according to the maximum or the integral value of an output from each pixel of said line sensor.
[Claim 14] A solid display unit given in any 1 term of claims 10-13 characterized by for said detected high-level maximum width judging with a decision means whether it is less than the range of predetermined width of face, and updating said observer's head positional information at the time less than of the range of predetermined width of face.
[Claim 15] A solid display unit given in any 1 term of claims 10-14 characterized by judging with a decision means whether either of the both ends of said detected high-level maximum width is in agreement with the maximum of the detection range, or the minimum value, and updating said observer's head positional information when not in agreement.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention is suitable for television which displays a solid image about a solid display unit, video, a computer screen, a game machine, etc.
[0002]
[Description of the Prior Art] Conventionally, as a method of a solid display, a polarization condition is changed, respectively, the parallax image for right eyes and the parallax image for left eyes are displayed, and there is a thing which an observer separates a parallax image on either side using polarization glasses, and makes check by looking as a solid image. For example, in order to change the polarization condition of a parallax image on either side, a liquid crystal shutter is prepared in a display side, a polarization condition is changed synchronizing with the field signal of the display image of a display, and the method which the observer who covered polarization glasses separates an one eye [every] right-and-left image by time sharing, and makes stereoscopic vision possible is put in practical use.
[0003] Furthermore, a liquid crystal shutter is formed in a glasses side, a parallax image on either side is made to check by looking appropriately by synchronizing this with the display image of a monitor, and some methods of making an observer recognize a solid image etc. are also put in practical use.
[0004] However, by these methods, the observer had the fault that the glasses for stereoscopic vision always had to be covered.
[0005] To it, as a solid display method which does not use polarization glasses, a lenticular lens is prepared in the front face of an image display side, and there is a lenticular lens method which separates the image which is in an eye on either side spatially.
[0006] Drawing 16 is the explanatory view of the solid display unit of the conventional lenticular lens method. The inside of drawing, and 151 It is a liquid crystal display and is the display picture element part 153 of liquid crystal. A glass substrate 152 and 154 It is formed in between. Liquid crystal display 151 Lenticular lens 155 with which a cross section is from the cylindrical lens of a large number respectively prolonged in the direction of a right angle of space in the shape of a semicircle like illustration on an observer side He has prepared and is trying to locate the display picture element part 153 of liquid crystal in the focal plane.
[0007] display picture element part 153 **** -- the stripe image is displayed. This stripe image is explained. Stripe images are two or more parallax images from two or more views. (image with parallax) It compounds. For compounding a stripe image, it is at least 2. The parallax image of ** is needed. Here, the parallax image corresponding to RS and a left eye for the parallax image corresponding to a right eye is set to LS. It is the pixel group of the shape of a longwise stripe about each parallax image. (henceforth a stripe pixel) It divides into Ri and Li (i= 1, 2, 3 ...). And the stripe pixel obtained from each parallax image is arranged by turns, namely, it is each stripe pixel R1, L2, R3, and L4 .... (or L1, R2, L3, R4, ...) It arranges and is 1. It is the stripe image which constituted the image of **. 3 hereafter said on these specifications A dimension image is this stripe image. Moreover, it is called stripe composition to form the above stripe image.
[0008] if -- a parallax image -- A, B, and C 3 if it is ** -- a stripe image -- each stripe pixel -- A1, B-2, C3, A4, B5, C6, ... or B1 and C2, A3, B4, and C5 and A6 .... or -- C1, A2, B3, C4, A5, and B6 -- it becomes the image compared with ....
[0009] display picture element part 153 **** -- the stripe pixel for right eyes of the shape of a stripe prolonged in the direction of a right angle of space like illustration corresponding to one pitch of a lenticular lens (black-lacquered part), and the stripe pixel for left eyes (part of void) -- a pair -- carrying out -- alternation -- arranging

-- **** -- the flux of light from these stripe pixels -- lenticular lens 155 It separates into a field with an observer's right eye ER and a left eye EL optically, and stereoscopic vision becomes possible.
[0010] the inside of drawing -- display 151 the common area which has shown both ends and the spatial field which can observe the object for the right eyes of a central part, and each of the image for left eyes, carries out right-and-left separation and is visible to an observer eye (the both-eyes center distance is e) over the whole screen surface -- stereoscopic vision field 156 of the thick wire part in drawing it is . In addition, this stereoscopic vision field 156 Right-and-left separation is carried out also in an adjoining field (un-illustrating), and the stereoscopic vision field which can carry out stereoscopic vision exists.
[0011] Moreover, as a glasses-less three dimentional display method, there is a parallax barrier method other than the above-mentioned lenticular lens method. Hereafter, this PARAKKUSU barrier method is explained.
[0012] As for the solid image display method using a parallax barrier, the technique is indicated by S.H.Kaplan. (21 59 "Theory of Parallax Barriers", J.SMPTE, Vol. No. 7, pp.11- 1952) . By displaying the stripe image compounded from the parallax image on either side previously explained also in this method, and minding the slit (called a parallax barrier) which has predetermined opening prepared in the location which only a predetermined distance separated from this stripe image, an observer separates and observes the parallax image corresponding to each eye by the eye of each right and left, and acquires stereoscopic vision.
[0013] With such conventional equipment, it is this 2 like the usual television It was not able to be used as a dimension image display device.
[0014] Then, in JP,3-119889,A and JP,5-122733,A, a parallax barrier is electronically formed by a transparency mold liquid crystal device etc., and the solid image display device controls a configuration, a location, etc. of a parallax barrier electronically and it was made to change is indicated.
[0015] Drawing 17 is the important section schematic diagram of the solid image display device currently indicated by JP,3-119889,A. With this equipment, it is the image display side 101. Thickness d Spacer 102 Electronic formula parallax barrier 103 which minds and consists of a transparency mold liquid crystal display component It arranges. image display side 101 **** -- 2 the stripe image of the length constituted from a parallax image picturized a direction or from many -- displaying -- on the other hand -- electronic formula parallax barrier 103 **** -- XY address -- microcomputer 104 etc. -- by specifying by the control means, a parallax barrier is formed in the location of the arbitration on a barrier side, and stereoscopic vision is made possible according to the principle of said parallax barrier.
[0016] It sets to this equipment and is 2. In case dimension image display is performed, it is the electronic formula parallax barrier 103. It is 2 by stopping formation of a barrier stripe and changing into a transparent and colorless condition over the whole region of an image display field. Dimension image display is performed. Usual 2 which was not made by the solid image display method using the conventional parallax barrier by this Compatibility with a dimension image display device is realized.
[0017] Drawing 18 is the important section schematic diagram of the liquid crystal panel display currently indicated by JP,3-119889,A and the solid image display device constituted by the electronic formula barrier. With this solid image display device, it is 2. The liquid crystal layer 115 of **, and 125 It is 2, respectively. The polarizing plate 111 of **, and 118 121 And 128 It inserts and is the liquid crystal layer 115. An image display means and liquid crystal layer 125 It is made the configuration made into electronic formula barrier means forming.
[0018] It also sets to this equipment and is 2. In case dimension image display is performed, it is the liquid crystal layer 125. It is 2 by stopping formation of a barrier stripe and changing into a transparent and colorless condition over the whole region of an image display field. Dimension image display is performed and it is usual 2. Compatibility with a dimension image display device is realized.
[0019] Moreover, electronic formula parallax barrier 103 which changes from a transparency mold liquid crystal display component to JP,5-122733,A as shown in drawing 19 It considers as the configuration of arbitration which can make only a field generate the pattern of a barrier stripe in part, and is 3. A dimension image and 2 The example which made it possible to indicate the dimension image by mixture within the same screen is indicated.
[0020] The range which whose width of face of the field which can carry out stereoscopic vision is narrow, and can carry out stereoscopic vision of the observer in the solid display unit which constitutes and displays a stripe image like the lenticular lens method explained in the top or a parallax barrier method, and makes stereoscopic vision possible has only the one half of the width of face of about 65mm of both-eyes center distances at the

maximum. Therefore, the observer needed to observe the location of the head, as it fixed, and he had the fault of it having been stabilized and being hard to carry out stereoscopic vision.
[0021] To it, in order to make the field of this stereoscopic vision large, the location of an observer's both eyes is detected, and the method which extends a stereoscopic vision field is proposed at JP,2-44995,A by carrying out migration control of the relative position of the longitudinal direction of a lenticular lens and a display device according to this.
[0022] Moreover, in JP,2-50145,A, an observer's both-eyes location is detected, the location of right and left of the stripe pixel of the parallax image for right eyes corresponding to a lenticular lens and the parallax image for left eyes is replaced with the signal, and the method which makes a stereoscopic vision field large is proposed.
[0023] Here, the means which detects the location of an observer's both eyes and makes a stereoscopic vision field large is explained briefly. As a detection means of an observer's both-eyes location, an observer is arrested with a camera, the profile is extracted or the image-processing approaches, such as looking for an observer with pattern matching, are proposed.
[0024] Drawing 20 is the explanatory view of the principle which a lenticular lens is made to follow on the occasion of migration of an observer's longitudinal direction in a lenticular lens method. 400 in drawing It is an observer before a change and, for 400', an observer is distance a from a position to a longitudinal direction. It is a location when moving. 401 It is one cylindrical lens which constitutes a ** lenticular lens, and 401' follows a watcher and is this cylindrical lens after migration. b It is the movement magnitude of a cylindrical lens (= lenticular lens), and 402 at the time of ****. The display picture element part and f which display a right stripe pixel (black painting) and a left stripe pixel (void) The focal distance of a cylindrical lens, and S It is observation distance.
[0025] usually, the time of the relation of S>>f being realized -- an observer's longitudinal direction -- a if only following bb=f-a/S moves a lenticular lens to migration -- a stereoscopic vision field -- a longitudinal direction -- a only -- it moves.
[0026] In addition, although the example to which a lens is moved here was explained, it is the display picture element part 402. The same effectiveness is acquired even if it makes it move to a lenticular lens.
[0027] In the top, when an observer moved to a longitudinal direction to a solid display, the principle which a stereoscopic vision field is made to follow was explained. However, an observer may move not only in a longitudinal direction but in the depth direction to a solid display, and it may separate from him from a stereoscopic vision field in the depth direction depending on the case.
[0028] The proposal which solves this trouble in JP,4-122922,A is 3 lenticular. It is indicated by the method which indicates the dimension image by projection. By this proposal, the location of an observer's depth direction is also detected and stereoscopic vision flattery of the depth direction is also enabled at coincidence.
[0029] Two or more following approaches are indicated by above-mentioned JP,2-50145,A as a location detection means of an observer's longitudinal direction.
(a) Mainly floodlight infrared radiation and detect the return light.
(b) Project infrared light on an observer and it is Rhine-like CCD about the reflected light from an observer. It wins popularity and detects to image sensors.
(c) Project infrared radiation from an observer tooth back, and detect from the quantity of light distribution of an electric eye prepared in the front face.
(d) Perform profile extract processing from an observer's image with a TV camera, and an image recognition technique detects a both-eyes location further.
[0030] Moreover, two or more following means are indicated by above-mentioned JP,4-122922,A as a location detection means of the depth direction.
(a) It is a distance detector using infrared radiation 2 The **** approach for bases.
(b) 2 Approach by the image processing of the camera of a base.
[0031]
[Problem(s) to be Solved by the Invention] The following technical problems occurred in the above-mentioned conventional solid display unit.
[0032] (1) In what detects an observer's location by infrared light emitting/receiving, since distinction of the return light from an observer and noise light does not stick when there is a noise which otherwise generates infrared light according to an exposure and light-receiving of mere infrared radiation, it has a bad influence on detection precision and detection dependability.

[0033] (2) The observer was picturized with the camera etc., in the solid display unit which detects the observation location by the image processing, the huge operation was needed for detection, and high-speed detection became difficult, therefore the rate of flattery of a stereoscopic vision field became slow, and a satisfying slew rate was not able to be secured. Furthermore, since a high speed and a highly efficient calculation function were needed as equipment, there was a problem used as cost quantity.
[0034] The purpose of this invention is offer of a solid display unit with possible making a stereoscopic vision field follow a high speed, though it is simple structure by modulating and floodlighting infrared light on an observer's head or it detects the reflected light with two or more light-receiving means, detecting the reflected light with the light-receiving means of a line sensor, processing the output appropriately, and detecting an observer's head location.
[0035]
[Means for Solving the Problem] Solid display unit of this invention (1-1) The parallax image for right eyes and the parallax image for left eyes are divided into a stripe-like stripe pixel, respectively. The stripe image which puts these stripe pixels in order in predetermined sequence, and constitutes them is displayed on an image display means. In the solid display unit which a binocular parallax image is displayed [display unit] for the flux of light from this stripe image by deviation optical elements, such as a lenticular lens and a parallax barrier, and a predetermined stereoscopic vision field is formed [display unit], and makes an observer observe a stereoscopic model It has the head location detection means equipped with an infrared light floodlighting means to irradiate by the infrared light which modulated this observer, and a light-receiving means to receive alternatively the modulated this infrared light which this observer reflects. The means to which a stereoscopic vision field is moved based on this observer's head location which this head location detection means detects is characterized by making this stereoscopic vision field follow etc.
[0036] Especially (1-1-1), A means to make said stereoscopic vision field follow moves deviation optical elements, such as said lenticular lens or said parallax barrier, based on said observer's head location, and moves said stereoscopic vision field. .
(1-1-2) Said infrared light floodlighting means has a diaphragm means to restrict the floodlighting range of the vertical direction.
(1-1-3) Said infrared light floodlighting means or an infrared light light-receiving means has the adjustment device in which the direction of radiation or the light-receiving direction of said infrared light can be adjusted in a vertical plane.
(1-1-4) Said infrared light floodlighting means modulates the infrared light which this irradiates on a predetermined frequency, and said light-receiving means receives the infrared light which said observer reflects with a synchronous means synchronizing with this modulation.
(1-1-5) The modulation frequency of said infrared light floodlighting means is set up so that it may differ from the integral multiple of the display frequency of said image display means.
(1-1-6) In case the infrared light which said observer reflects is received with said light-receiving means, control the luminescence reinforcement of said infrared light luminescence means so that the amount of the infrared light which this light-receiving means receives becomes fixed.
(1-1-7) said head location detection means -- 2 said light-receiving means of ** -- horizontal -- detaching -- having -- this -- 2 from the difference of the output of the light-receiving means of ** -- this -- difference -- this -- 2 Said observer's head location is detected from the value which **(ed) by the output sum of the light-receiving means of **.
(1-1-8) Said light-receiving means is a line sensor which has arranged two or more pixels horizontally, carries out image formation of said observer's image on this line sensor, and detects this observer's head location based on the center-of-gravity location of this image detected from the signal from this line sensor.
(1-1-9) the signal from each pixel of said line sensor -- 2 a value-ized means -- a predetermined threshold -- 2 of high level or a low level a value -- changing -- this -- 2 If it is the high-level maximum width or negative logic of a signal value-ized, a width-of-face detection means will detect the maximum width of a low level, and let the center position be said observer's head location.
(1-1-10) Control the luminescence reinforcement of said infrared light floodlighting means according to the maximum or the integral value of a signal from each pixel of said line sensor.
(1-1-11) Control the amplification factor of the signal from this line sensor according to the maximum or the integral value of a signal from each pixel of said line sensor.

(1-1-12) Control said threshold according to the maximum or the integral value of an output from each pixel of said line sensor.
(1-1-13) Said detected high-level maximum width judges with a decision means whether it is less than the range of predetermined width of face, and updates said observer's head positional information at the time less than of the range of predetermined width of face.
(1-1-14) Judge with a decision means whether either of the both ends of said detected high-level maximum width is in agreement with the maximum of the detection range, or the minimum value, and when not in agreement, update said observer's head positional information. It is characterized by things etc.
[0037]
[Embodiment of the Invention] Drawing 1 Operation gestalt 1 of the solid display unit of ******** It is an external view. This operation gestalt is the solid display unit which used the lenticular lens method. drawing 7 from the following and drawing 1 using -- operation gestalt 1 ******** -- it explains.
[0038] Drawing 1 Inside and 500 It is the notation of this whole equipment. 600 It is the solid image display section using a ** lenticular lens method. 300 It is a ****** location detection sensor and is an infrared light floodlighting system. (infrared light floodlighting means) Light-receiving system (light-receiving means) It has and an observer's head location is detected. In addition, this head location detection sensor 300 It has the adjustment device, i.e., the include-angle adjustment device of the vertical direction, in which the direction of radiation and the light-receiving direction of infrared light of [within a vertical plane] can be adjusted according to an observer's physique. Drawing 2 ****** gestalt 1 It is the block diagram of a system. The inside of drawing, and 1 It is a lenticular lens (it calls for short that it is lenticular henceforth), and is the image display means 2. It receives and can move to a longitudinal direction. image display means 2 For example, a liquid crystal display component, a plasma display device, and CRT etc. -- it constitutes and the stripe image mentioned later is displayed.
[0039] 400 ******** and 300 The aforementioned head location detection sensor and 3 Head location detection sensor 300 from -- it is the head location detector which processes a signal. 4 It is the controller which controls the ****** gestalt 1 whole, and is the head location detector 3. The acquired head positional information is also inputted into this controller as one signal. 5 It is a ** sliding mechanism and is the specified quantity image display means 2 about a lenticular sheet 1. It receives and is made to move to a longitudinal direction. 6 ** sliding mechanism 5 It is the slide drive circuit to drive.
[0040] in addition, the head location detection sensor 300 and the head location detector 3 etc. -- an element of a head location detection means is constituted. moreover, a sliding mechanism 5 and the slide drive circuit 6 etc. -- an element of a means which a stereoscopic vision field is made to follow is constituted.
[0041] Drawing 3 ****** gestalt 1 Sliding mechanism 5 It is an explanatory view. inside of drawing, and 1a -- lenticular sheet 1 The pin prepared in one, and 1b, 1c, 1d and 1e are the mounting eyes of a spring. 10a 10b, 10c, and 10d Lenticular sheet 1 It is the parallel flat spring which presupposes only at a longitudinal direction that it is movable, and supports only predetermined spacing floating from a housing (un-illustrating).
[0042] 11 is 11a. Slot 11b which rotates as the center of rotation and which is a lever and was prepared in this Engaged lenticular sheet 1 Pin 1a is minded and it is a lenticular sheet 1. Migration control is carried out at right and left. 11c It is the sector gear prepared in a part of ** lever. The DC motor which is a source of power for 12 to rotate this lever, and 13 are sector gear 11c of a lever 11. He is a gearing for minding and making power transmit.
[0043] A permanent magnet for 14 to generate a field and 15 are the hall devices which detect the flux density of a magnet 14, and are a lenticular sheet 1. It is detected as a changed part of this magnetic flux, and movement magnitude is a lenticular sheet 1 based on this value. Feedback control of the amount of slides is carried out.
[0044] Drawing 4 ****** gestalt 1 Head location detection sensor 300 It is an important section perspective view. The infrared emitting diode (infrared rays LED) whose 20 are the light source for floodlighting, and 21 are the cylindrical lenses for irradiating the head above an observer's shoulder among drawing. B It is a diaphragm means to restrict the floodlighting range of the vertical direction of the exposure flux of light from ******. infrared LED 20, a cylindrical lens 21, and diaphragm means B etc. -- infrared light floodlighting system (infrared light floodlighting means) An element of 34 is constituted.
[0045] 22R 22L The condensing lens and 23R which condense the reflected light of the infrared light floodlighted to the observer 23L The infrared light transparency filter and 24R which shade except infrared light 24L It is the photo transistor which receives infrared light and is changed into an electrical signal. condensing

lens 22R, infrared light transparency filter 23R, and photo transistor 24R etc. -- right-hand side light-receiving system (light-receiving means) 30R an element -- constituting -- **** -- condensing lens 22L, infrared light transparency filter 23L, and photo transistor 24L etc. -- left-hand side light-receiving system (light-receiving means) 30L An element is constituted. In addition, R given to a notation in this specification And L It expresses that they are a right-hand side element and a left-hand side element, respectively.

[0046] Drawing 5 ****** location detection sensor 300 It is the explanatory view of a detection principle. the inside of drawing, and x The movement magnitude of the head from the center position (shaft of a sensor) of a sensor, and S Observer 400 from -- photo transistor 24R 24L distance with the connected line, and LL -- observer 400 from -- photo transistor 24L up to -- distance and LR -- observer 400 from -- photo transistor 24R up to -- distance and d They are a photo transistor and the distance based on sensors.

[0047] Drawing 6 In a **** operation gestalt, it is the output Fig. of a photo transistor for which the artificer asked experimentally. The inside of drawing and VR are photo transistor 24R. The output of photo transistor 24L and VP of an output and VL are the peaks of an output value. these outputs -- observer 400 from -- the location of the shortest [distance / LR and LL / to a photo transistor], i.e., the location as for which an observer does a right pair to each photo transistor, i.e., x=d, And it becomes max in the location of x=-d. According to experimental data, since the output of each photo transistor serves as a quadratic curve in approximation near the maximum, alpha, then each output are expressed as VR=VP-alpha (x-d) 2 VL=VP-alpha (x+d) 2 in the synthetic parameter of the optical system of a photo transistor, or an electric system. If these differences are taken, it is set to VR-VL=4dalphax and is an observer's migration length x. 2 It turns out that the output difference of the photo detector of ** is in proportionality.

[0048] moreover, the relation explained by drawing 20 of the conventional example -- x=a it is -- since -- lenticular sheet 1 for making a stereoscopic vision field follow migration of an observer's longitudinal direction Movement magnitude b Lenticular sheet 1 the focal distance of the cylindrical lens to constitute -- f ** -- it carries out and becomes b=f(VR-VL)/(4dalphaS).

[0049] Drawing 7 ****** gestalt 1 It is a block diagram showing the flow of a signal. This explains the flow of processing of the operation gestalt 1. Inside of drawing, and 30R 30L It is the right-hand side light-receiving system and left-hand side light-receiving system which were explained above. 31R 31L Pre amplifier and 32R which carry out alternating current amplification of the signal from each light-receiving system to a suitable output 32L The rectifier circuit and 33R which rectify the AC signal from each pre amplifier 33L It is the low pass filter which graduates the signal rectified in each rectifier circuit.

[0050] For 34, the infrared light floodlighting system explained above and 35 are infrared rays LED by the predetermined control signal. LED which controls and drives luminescence timing and luminescence reinforcement It is a driver. 36 is OSC. for a modulation, modulates floodlighting light on a predetermined frequency, and removes the effect of disturbance light other than infrared light floodlighting systems, such as an indoor fluorescent lamp. The signal for this modulation has removed the effect of disturbance light by supplying and synchronizing in an infrared light floodlighting system and pre amplifier 31R and 31L. Moreover, this modulation frequency is the image display means 2. It sets up so that it may differ from the integral multiple of a display frequency, and effect from image display is made small. in addition, the object for a modulation -- OSC.36 and LED A driver 35, pre amplifier, etc. constitute an element of a synchronous means. low pass filter 33R equivalent to the output VR which explained 37 above from -- low pass filter 33L equivalent to a signal and an output VL from -- it is the subtractor which calculates the difference of a signal and this value shows an observer's head location.

[0051] 38 -- low pass filter 33R 33L from -- it is the adder which asks for the sum of the value of a signal, and this value represents the reinforcement of the quantity of light which has reached the observer.

[0052] the quantity of light predetermined in 39, and the output of the quantity of light calculated with the adder 38 -- the subtractor for calculating difference and 40 are the quantity of light error amplifier for amplifying the difference of the quantity of light. It is through LED about a subtractor 39 and the quantity of light error amplifier 40 so that the value of an adder 38 may always become fixed with this operation gestalt. Feedback is hung on a driver 35. Thereby, it is drawing 6. Head location x Output V The output which relation became the same almost always and was stabilized comes to be obtained. Furthermore, (VR-VL)/(VR+VL) By calculating, the stable output is obtained further.

[0053] 41 is an observer's head position signal and lenticular sheet 1 which were obtained from the subtractor 37. It is the tuning amplifier for taking adjustment with the signal for carrying out movable. The power

amplification constituted from a power transistor etc. in order that a subtractor for 42 to constitute the feedback control system of a sliding mechanism and 43 might carry out the signal of a subtractor 42 and magnification or the servo error amplifier for finding the integral or differentiating, and 44 might carry out power amplification of the signal of the servo error amplifier 43, and 45 are drawing 3. It is a sliding mechanism and is a lenticular sheet 1. It is made to move. 46 is drawing 3. It is a permanent magnet 14 and the lenticular location sensor which added the electronic circuitry for detection to the hall device 15, and is a lenticular sheet 1. A location is detected.

[0054] such an equipment configuration -- setting -- observation distance S a basis -- the movement magnitude x of an observer's head location -- asking -- lenticular sheet 1 b only -- if it is made to move, a stereoscopic vision field can be made to follow synchronizing with migration of an observer

[0055] According to this operation gestalt, it is possible to face to detect an observer's head location, to remove the effect of disturbance light compared with the approach by the conventional image processing, and to detect the location at a high speed more with a simple configuration.

[0056] next, operation gestalt 2 ******** -- it explains. operation gestalt 1 **** -- the return luminous intensity of infrared light -- detecting -- an observer's migration length x Since it asked, detection might become unstable with a difference and observation distance of an observer's reflection factor. Operation gestalt 2 This trouble is canceled.

[0057] Operation gestalt 2 It sets, infrared radiation is projected on an observer's head, image formation of an observer's image is carried out to a line sensor using that return light, an observer's head location is detected from the profile of the observer head on it, and it is this head location. (observation location) To a basis, it is a lenticular sheet 1. It is made to slide to a longitudinal direction mechanically, and a stereoscopic vision field is followed. In addition, operation gestalt 2 A line sensor is a charge-coupled device (CCD) which has arranged two or more pixels horizontally. It uses.

[0058] Drawing 8 Operation gestalt 2 of the solid display unit of ******** It is the important section perspective view of the head location detection sensor 300. 20 The inside of drawing, and 21 B It is the same infrared emitting diode as the operation gestalt 1, a cylindrical lens, and a diaphragm means, and the floodlighting system B1 is constituted. The light-receiving lens to which image formation of an observer's image which 50 floodlighted infrared light and was illuminated is carried out, the infrared light transparency filter with which 51 shades except infrared light, and 52 are the line sensors formed at a level with the image formation location of the light-receiving lens 50, by the circuit for read-out, measure the strength of the light and change the single dimension light-receiving reinforcement of the longitudinal direction of a sensor into an electric signal. In addition, a lens 50, the infrared light transparency filter 51, and line sensor 52 grade are a light-receiving system. (light-receiving means) An element of B-2 is constituted.

[0059] Drawing 9 ****** gestalt 2 Head location detection sensor 300 It is the explanatory view of a detection principle. Operation gestalt 1 He is an observer 400 similarly. Infrared rays LED 20 It is illuminated by the cylindrical lens 21. Only the light-receiving system is illustrated in this Fig. Observer 400 illuminated by the infrared light floodlighting system Image formation of the image is carried out on a line sensor 52 with a lens 50. Since an observer's part which carried out image formation on the line sensor 52 has brightness higher than other parts, if this part is detected and a center of gravity is calculated, an observer's head location will be obtained.

[0060] The procedure below an outline performs detection of this observer's head location.

** Project infrared light on an observer head.

** Carry out image formation of an observer's head image on a line sensor through an infrared transparency filter.

** Amplify the analog signal of a line sensor to proper level.

** About the analog signal of the amplified line sensor, it is high level somewhat from a background noise. (threshold) It compares and is 2. It changes into a value-ized signal. Here, since the part with high-level level is a part near a sensor (display), it can be considered that it is an observer.

** 2 The value-ized high-level width of face is detected, and the width of face considers as an observer's head location in quest of the center position of the high-level maximum width by using the largest part as an observer head.

** Head location data which will have been memorized in equipment if the dependability of the above-mentioned count is checked and predetermined conditions are fulfilled (head positional information) It updates.

Moreover, linearity amendment is performed if needed.
** Transmit the obtained observer location data to the servo-system circuit to which a lenticular sheet is made to slide.

[0061] Following and operation gestalt 2 Order is explained for an operation later on. Drawing 10 is a head location detection value and a lenticular sheet 1. It is the explanatory view of the relation of the amount of slides. And drawing 10 (A) Head location detection sensor 300 An operation explanatory view and drawing 10 (B) Lenticular sheet 1 It is the explanatory view of movement magnitude. the inside of drawing, and SD -- the distance from an observer to the lens 50 of a head location detection sensor, and 400' -- the observer location after migration, and SD' the distance from the observer after migration to a lens 50, and fD -- the focal distance of a lens 50, and thetaD Observer 400 the straight line which connects the principal point of a lens 50 -- the datum line (optical axis of a light-receiving system) The include angle to make and xD are head detection locations which a line sensor 52 detects.

[0062] Drawing 10 (B) Setting, 1L is a lenticular sheet 1. One cylindrical lens and f to constitute The focal distance, SL, and SL' of this cylindrical lens The distance from an image display means to an observer, and b Lenticular sheet 1 Movement magnitude and thetaL It is the include angle of the line and the datum line which connect the principal point of cylindrical-lens 1L to an observer to make.

[0063] Drawing 10 (A) He is an observer 400, if it sets and the depth of field of a lens 50 are enough. Regardless of a location, it is thetaD. The relation of xD turns into proportionality.

[0064] Moreover, drawing 10 (B) He is an observer 400 then. Regardless of distance, it is thetaL. b Relation is in proportionality. In one solid display unit, it is thetaD. thetaL Since it becomes the same value, it is xD and the lenticular sheet 1 of a head location detection value. The amount b of slides Since what is necessary is just to make it proportionality, it is the amount b of slides based on the detection value xD regardless of an observer's distance. It is controlling and flattery of a stereoscopic vision field can be realized.

[0065] Drawing 11 is the operation gestalt 2. It is the block diagram showing the whole configuration. the inside of drawing, and B1 -- a floodlighting system -- it is -- infrared rays LED -- it consists of a cylindrical lens 21 which extracts 20 and this infrared light to the flux of light of the shape of a beam long in a longitudinal direction, and is driving by the predetermined approach. B-2 is a light-receiving system and consists of a line sensor 52 which changes the image by which image formation was carried out to the light-receiving lens 50 for carrying out image formation of the infrared (IR) filter 51 and an observer's head image which penetrate the illuminated return light from an observer into an electrical signal.

[0066] this line sensor -- charge-coupled device (CCD) it is -- since -- since this line sensor 52 is driven -- 1 of detection microcomputer B4 to a line sensor The shift pulse which determines a scan time, and oscillator B11 from -- counting-down circuit B12 It minds, the clock for a line sensor drive and the clock for data read-out are supplied, and the luminance signal of each pixel is outputted with an analog quantity.

[0067] B3 -- 2 Value-ized processor (2 value-ized means) it is -- amplifier B14 which amplifies the analog signal acquired from the line sensor 52 to a suitable value with a certain amplification factor a certain threshold -- comparing -- 2 of high level or a low level Comparator B15 changed into a value from -- it has become. B4 is a detection microcomputer and is 2. The signal from the value-ized processor B3 is received, and it is count of an observer's location, and 2. It processes transmitting the dependability check of a value-ized signal or a count result, and count data to servo microcomputer B5 etc.

[0068] B5 is the desirable lenticular sheet 1 for being a servo microcomputer, receiving observer location data from detection microcomputer B4, and making a stereoscopic vision field follow from this. A location is converted, a controlled variable is calculated as compared with the lenticular positional information from lenticular location sensor B6, and it is Motor Driver B54 of the slide drive system B7 about this. It outputs.

[0069] the slide drive system B7 -- drawing 3 Sliding mechanism B55 which consists of the lenticular slide support device and lenticular motor which were explained, a moderation gear, etc. Motor Driver B54 etc. -- it has, and a lenticular right-and-left location is controlled in response to the control signal from servo microcomputer B5, and a stereoscopic vision field is made to follow to an observer location

[0070] It sets to drawing 11 and is an oscillator B11. While supplying a basic clock to microcomputer B4 for detection, it is a counting-down circuit B12 about the same basic clock. The formed clock which supplies and carries out dividing is supplied to the line sensor 52. Moreover, 1 of a line sensor 52 The software of detection microcomputer B4 generates the shift pulse which determines a scan time, it is outputted to a line sensor 52, and is controlling this. It is the amplifier B14 with which this signal performs subtraction and magnification since

the analog signal from a line sensor 52 is feeble and a part for direct-current bias is included. It amplifies to suitable level. It is a comparator B15 about this amplified signal. It compares with a certain threshold and is 2. It is inputted into detection microcomputer B4 as a value-ized signal, and an observer's head location is detected here.
[0071] Moreover, it is DA converter B16 from detection microcomputer B4. A signal is taken out and it is the drive circuit B17. It minds and they are infrared rays LED 20. Luminescence reinforcement is controlled and an observer's exposure reinforcement is controlled appropriately.
[0072] In an observer's location detection, it is the floodlighting system B1 in the block diagram of drawing 11, light-receiving system B-2, and 2. Although the value-ized processor B3, detection microcomputer B4, etc. are related, the software processing inside detection microcomputer B4 is mainly explained here.
[0073] Drawing 12 is the flow chart of the program performed inside detection microcomputer B4. This is explained.
[0074] Step S1 is a step which sets up the input/output port of a microcomputer etc., and is 2. It is 2 by the value-ized processor. A setup of the input port of the value-ized signal is also performed here. At step S2, it is 1 of a line sensor. The shift pulse which reads with a scan time and determines start time is generated. Step S3 is a step which carries out the standby to the read-out location on the line sensor to which the image is connected optically. It is the brightness signal of an object including the observer whom a line sensor 52 outputs in step S4 1 Pixel [every] sequential incorporation and its 2 It is the step which asks for the high-level width of face of the value-ized output one by one, and asks for the high-level maximum width and its location. (Processing of this step is explained independently.) Step S5 is a step which verifies the dependability of the maximum width and calculates an observer's location (core of a pulse) from the high-level width of face and the high-level location which were obtained. (Processing of this step is explained independently.) Step S6 is a step which carries out linearity amendment of the nonlinear part (both ends) of a sensor output. Step S7 is a step which transmits an observer's obtained location data to the servo circuit containing servo microcomputer B5. Step S8 is based on the output of the line sensor 52 detected now, and they are infrared rays LED 20. It is the step which controls luminescence reinforcement. Step S9 detects an observer's location next, is standby until it corresponds to this, will progress again after predetermined time at step S2, and will constitute an endless loop from a step S2 between S9.
[0075] Drawing 13 is 2 performed by step S4 in detection microcomputer B4 explained by drawing 12. It is the flow chart of the program which asks for the high-level maximum width of a value-ized output. This is explained.
[0076] Step S4a It is the register used by this routine compulsorily 0 It is the step to clear. The register used here is the count of this loop formation, i.e., the read-out location on a line sensor. (address) Shown Count A register and Width which stores high-level width of face temporarily LastAdd which stores the address of the termination of a register, the WidthMax register which updates and stores the maximum of high-level width of face, and WidthMax It consists of a register. 8 bits consists of these operation gestalten for these registers as one unit. moreover, a detection span -- Count a register -- 0 from -- it has prepared so that 255 may be taken.
[0077] Step S4b Count of a line sensor 52 It is 2 from the input port of the microcomputer which set up the output from the pixel of the address specified with a register at step S1. It is the step read as a value-ized output. Step S4c This 2 It is the step which judges whether it is [output / which was value-ized] high-level in a low level. Step S4d It is Width then. A register is increased +one. Step S4e It will be step S4f, if it is the step which calculates (WidthMax-Width) and judges that positive/negative and this value serves as negative. A WidthMax register is updated. Step S4g The termination value of a WidthMax register (LastAdd value of a register) It is the step to update.
[0078] Step S4i Count It is the step to increase +one about a register. Step S4j Count A register is overflow, 255 [i.e.,]. It is the step which judges whether it exceeded or not.
[0079] Step S4k 2 It is Width when the value-ized output is a low level. It is the step which clears a register. Step S4h S4m S4n It is the step of the delay which wastes predetermined time amount, respectively and arranges the processing time of each loop formation.
[0080] As flow of this routine, it is Count. A register is 255. It is decision step S4c until it overflows. S4e Following 3 In accordance with the loop formation of a passage, it turns around a loop formation in this routine, and processing progresses. Moreover, step S4h S4m S4n This 3 It is the time delay step prepared so that the processing time of the loop formation of ** might be made the same.

[0081] ** step S4b ->S4c ->S4d ->S4e ->S4f ->S4g ->S4h ->S4i ->S4j from -- S4b Returning loop formation. Order is explained for this loop formation later on. Step S4b 1 incorporated from the line sensor 52 2 of a pixel A value-ized output is step S4c. It is step S4d if it is judged that it is high-level. Width Numeric value of a register Step S4e after increasing one It sets and is Width. The size relation of the numeric value of a register and a WidthMax register is compared.
[0082] It is Width here. It is step S4f if the value of a register is larger than the value of a WidthMax register. It is current Width spontaneously. The value of a register is stored in a WidthMax register and a numeric value is updated. Furthermore, step S4g It sets and is LastAdd. It is the present Count about the numeric value of a register. It updates with the value of a register. Subsequently, step S4h Elapsed time is adjusted and it is step S4i. It progresses. Step S4i It is Count of the address count on a line sensor then. +1 is added to a register and one is advanced to it. Subsequently, step S4j Count It is 255 when the value of a register is the number of pixels, i.e., now. It is step S4b, supposing it judges whether it overflowed or not and is not overflowing. It returns and the above-mentioned processing is performed about the following pixel.
[0083] In addition, Count If the value of a register is overflowing the number of pixels, it will finish processing of S4 and will progress to step S5.
[0084] ** step S4b ->S4c ->S4d ->S4e ->S4n ->S4i ->S4j from -- S4b Returning loop formation. Step S4b ->S4c ->S4d ->S4e Processing of until is the same as above **. Step S4e Width It is step S4n if the value of a register is smaller than the value of a WidthMax register. They are a WidthMax register and LastAdd spontaneously. It passes through adjustment of the processing time, without updating a register, and is step S4i. It progresses. step S4i ->S4j from -- S4b The returning processing is the same as above **.
[0085] ** step S4b ->S4c ->S4k ->S4m ->S4i ->S4j from -- S4b Returning loop formation. Step S4c One pixel in a line sensor (Count the address is specified with the register) 2 If a value-ized output is judged to be a low level step S4k Width which progresses and shows high-level width of face a register -- a clearance -- carrying out -- step S4m pass adjustment of the processing time -- step S4i progressing -- henceforth -- the above-mentioned step S4i ->S4j from -- S4b Returning processing is performed.
[0086] If step S4 shown in drawing 13 is processed, for the high-level maximum width, the address position of the termination of a WidthMax register is LastAdd to a WidthMax register. It is stored in a register. In addition, detection microcomputer B4 etc. constitutes an element of a width-of-face detection means which detects the high-level maximum width.
[0087] Drawing 14 is the flow chart of processing of step S5 in drawing 12. Here, it is step 4. The obtained high-level maximum width (WidthMax register) The address position of termination (LastAdd register) Dependability is verified and it is an observer's location. (head positional information) It calculates and is PosObs about the location. It stores in a register. In addition, Width-H in drawing The upper limit of WidthMax, and Width-L It is the lower limit of WidthMax.
[0088] It sets to drawing 14 and is step S5a. The start edge of the high-level maximum width is the start edge on a line sensor. (minimum value of the detection range) It judges whether it is in agreement. Here, WidthMax-(LastAdd+1) is 0. It confirms whether become or not and is 0. If it becomes, since the maximum width of a high-level pulse is restricted at the starting point of a line sensor 52 (it is missing), it judges that this acquired value is unreliable, and it progresses to the following step S6, without carrying out count and renewal of an observer's location. It is 0. If it does not come out, it is step S5b. It progresses.
[0089] Step S5b The termination of the high-level maximum width is the termination on a line sensor. (maximum of the detection range) It judges whether it is in agreement. Here, it is LastAdd+1. 0 It confirms whether become or not. It is 0. If it becomes, since the termination of the high-level maximum width is in agreement with the termination on a line sensor and the maximum width of a high-level pulse is restricted at the terminal point of a line sensor (it is missing), it judges that this acquired value is unreliable, and it progresses to the following step S6, without carrying out count and renewal of an observer's location. It is 0. If it does not come out, it is step S5c. It progresses.
[0090] Step S5c The value of a WidthMax register is Width-H of a upper limit. It is the step which confirms whether exceed or not, and if it seems that a upper limit is exceeded, it will progress to the following step S6, without carrying out count and renewal of an observer's location. If a upper limit is not exceeded, it progresses to step S5d.
[0091] It is Width-H of a upper limit here. In the range of this operation gestalt which can be followed, the value equivalent to width of face when an observer's head is the nearest, and the width of face which added

some margins is set up beforehand.

[0092] Step S 5d The value of a WidthMax register is Width-L of a lower limit. It is the step which confirms whether it is small, and if it seems that it turns around a lower limit the bottom, it will progress to the following step S6, without carrying out count and renewal of an observer's location. If a lower limit is not exceeded, it is step S5e. It progresses.

[0093] It is Width-L of a lower limit here. In the range of this operation gestalt which can be followed, the value equivalent to width of face when an observer's head is the furthest, and the width of face which lengthened some margins is set up beforehand. Step S5c And step S5d The high-level maximum width is the step which judges whether it is less than predetermined width of face.

[0094] Step S5e It is the step which asks for a high-level center position, and it asks by the operation of LastAdd-WidthMax/2, and the result is stored in PosObs as an observer's location. The above is processing of step S5. In addition, detection microcomputer B4 etc. constitutes an element of a decision means.

[0095] The output signal of 52 is 2 from a line sensor as mentioned above. It sets to the value-ized processor B3, and is 2 of high level or a low level at a predetermined threshold. It changes into a value-ized signal. However, if the distance of an observer's depth direction differs, the output values of a line sensor differ. That is, if an observer is far, the output of a line sensor 52 will become small, and it is a predetermined threshold The circumference of the bottom, and exact 2 A value-ized signal may not no longer be acquired.

[0096] For this reason, when the output of a line sensor 52 is small, they are infrared rays LED 20. It is necessary to raise luminescence reinforcement and to raise the output of a line sensor 52. It is AD converter B16 so that detection microcomputer B4 may investigate the integral value (total) or maximum output value of an output of a line sensor and this may become fixed with this operation gestalt. And drive circuit B17 It minds and they are infrared rays. 2 which controlled the luminescence reinforcement of LED20 and was stabilized It can be made to perform value-ized processing.

[0097] In addition, in addition to this, it is the amplifier B14 of the output signal of a line sensor 52. Control gain or it is 2. Change the threshold of value-ized processing or it is these 2. 2 similarly stabilized even by even combining two or more means of value-ized stability Value-ized processing can be performed.

[0098] Next, lenticular sheet 1 of this operation gestalt Drawing 11 explains the operation which controls a location by the servo-system circuit. A servo-system circuit is controlled by servo microcomputer B5 of drawing 11. This servo microcomputer B5 is the desirable lenticular sheet 1 which forms a stereoscopic vision field for observer location data from detection microcomputer B4 reception and after this corresponding to an observer's location. It converts and asks for a location. Lenticular sheet 1 The electrical-potential-difference value is changed into digital value by the AD converter built in servo microcomputer B5 by the current position being changed into an electrical potential difference by lenticular location sensor B6, such as a potentiometer or a hall device, and it is the desirable lenticular sheet 1. Difference with a location is calculated and it is a lenticular sheet 1. It is Motor Driver B54 about a controlled variable. It outputs. Motor Driver B54 Sliding mechanism B55 It drives and is a lenticular sheet 1. It is made to move to a desirable location and a stereoscopic vision field is made to follow an observer's location. in addition, the time of this actuation -- oscillator B51 from -- a clock is supplied to servo microcomputer B5 and timing is taken.

[0099] thus, the servo microcomputer B5-> Motor Driver B54 -> sliding mechanism B55 -- making -> lenticular sheet 1 -> lenticular location sensor B6-> servo microcomputer B5 and one loop formation -- lenticular sheet 1 Migration control is performed.

[0100] Drawing 15 is the flow chart of the program performed inside servo microcomputer B5. Step S51 It is the step which sets up the input/output port of a microcomputer etc., and a setup of the input port of an observation location is also performed from detection microcomputer B4 here.

[0101] Step S52 Lenticular sheet 1 Lenticular sheet 1 which is a location entry-of-data step and is outputted from lenticular location sensor B6 A position signal is inputted into the AD converter built in servo microcomputer B5, and it is the lenticular sheet 1 as digital value. Location data are obtained.

[0102] Step S53 It is the input step of the desirable lenticular location of **, an observer's location data are inputted from detection microcomputer B4, and it is the desirable lenticular sheet 1. It is the step converted into location data.

[0103] Step S54 Obtained desirable lenticular sheet 1 Location data and current lenticular sheet 1 PID which takes the difference of location data and carries out the load of the property of a proportional element (P-action), an integral element (integral action), or a derivative element (D action) if needed It is a count step and the

controlled variable to need is calculated.
[0104] Step S55 PWM It is the step of an output and is step S54. Based on the obtained controlled variable, the duty of the pulse of the electrical potential difference impressed to a motor is changed, and it is a lenticular sheet 1. It is made to move. This step S55 After finishing, it is step S52. A return endless loop is made.
[0105] Operation gestalt 2 Although modulated and floodlighted infrared light on an observer's head, the reflected light was detected with the light-receiving means of a line sensor, the output was processed appropriately and an observer's head location is detected, since the line sensor which has a sensitivity profile in a horizontal chisel in that case was used, the image processing of an observer's vertical direction can be omitted, the amount of operations can be lessened, and a stereoscopic vision field can be made to follow a high speed with simple structure.
[0106] In addition, although each above operation gestalt was the solid display unit of a lenticular lens method, also in the solid display unit which displays a binocular parallax image using deviation optical elements, such as a parallax barrier method, it is possible to detect an observer's head location with the same configuration as the above operation gestalt fundamentally, to move this parallax barrier etc. based on this observer's head location, and to move a stereoscopic vision field.
[0107]
[Effect of the Invention] Though it is simple structure by this invention's modulating and floodlighting infrared light on an observer's head by the above configuration or it detects the reflected light with two or more light-receiving means, and detecting the reflected light with the light-receiving means of a line sensor, processing the output appropriately, and detecting an observer's head location, a solid display unit with possible making a stereoscopic vision field follow a high speed is attained.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] Especially this invention is suitable for television which displays a solid image about a solid display unit, video, a computer screen, a game machine, etc.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] Conventionally, as a method of a solid display, a polarization condition is changed, respectively, the parallax image for right eyes and the parallax image for left eyes are displayed, and there is a thing which an observer separates a parallax image on either side using polarization glasses, and makes check by looking as a solid image. For example, in order to change the polarization condition of a parallax image on either side, a liquid crystal shutter is prepared in a display side, a polarization condition is changed synchronizing with the field signal of the display image of a display, and the method which the observer who covered polarization glasses separates an one eye [every] right-and-left image by time sharing, and makes stereoscopic vision possible is put in practical use.
[0003] Furthermore, a liquid crystal shutter is formed in a glasses side, a parallax image on either side is made to check by looking appropriately by synchronizing this with the display image of a monitor, and some methods of making an observer recognize a solid image etc. are also put in practical use.
[0004] However, by these methods, the observer had the fault that the glasses for stereoscopic vision always had to be covered.
[0005] To it, as a solid display method which does not use polarization glasses, a lenticular lens is prepared in the front face of an image display side, and there is a lenticular lens method which separates the image which is in an eye on either side spatially.
[0006] Drawing 16 is the explanatory view of the solid display unit of the conventional lenticular lens method. The inside of drawing, and 151 It is a liquid crystal display and is the display picture element part 153 of liquid crystal. A glass substrate 152 and 154 It is formed in between. Liquid crystal display 151 Lenticular lens 155 with which a cross section is from the cylindrical lens of a large number respectively prolonged in the direction of a right angle of space in the shape of a semicircle like illustration on an observer side He has prepared and is trying to locate the display picture element part 153 of liquid crystal in the focal plane.
[0007] display picture element part 153 **** -- the stripe image is displayed. This stripe image is explained. Stripe images are two or more parallax images from two or more views. (image with parallax) It compounds. For compounding a stripe image, it is at least 2. The parallax image of ** is needed. Here, the parallax image corresponding to RS and a left eye for the parallax image corresponding to a right eye is set to LS. It is the pixel group of the shape of a longwise stripe about each parallax image. (henceforth a stripe pixel) It divides into Ri and Li (i= 1, 2, 3 ...). And the stripe pixel obtained from each parallax image is arranged by turns, namely, it is each stripe pixel R1, L2, R3, and L4 .... (or L1, R2, L3, R4, ...) It arranges and is 1. It is the stripe image which constituted the image of **. 3 hereafter said on these specifications A dimension image is this stripe image. Moreover, it is called stripe composition to form the above stripe image.
[0008] if -- a parallax image -- A, B, and C 3 if it is ** -- a stripe image -- each stripe pixel -- A1, B-2, C3, A4, B5, C6, ... or B1 and C2, A3, B4, and C5 and A6 .... or -- C1, A2, B3, C4, A5, and B6 -- it becomes the image compared with ....
[0009] display picture element part 153 **** -- the stripe pixel for right eyes of the shape of a stripe prolonged in the direction of a right angle of space like illustration corresponding to one pitch of a lenticular lens (black-lacquered part), and the stripe pixel for left eyes (part of void) -- a pair -- carrying out -- alternation -- arranging -- **** -- the flux of light from these stripe pixels -- lenticular lens 155 It separates into a field with an observer's right eye ER and a left eye EL optically, and stereoscopic vision becomes possible.
[0010] the inside of drawing -- display 151 the common area which has shown both ends and the spatial field which can observe the object for the right eyes of a central part, and each of the image for left eyes, carries out right-and-left separation and is visible to an observer eye (the both-eyes center distance is e) over the whole

screen surface -- stereoscopic vision field 156 of the thick wire part in drawing it is . In addition, this stereoscopic vision field 156 Right-and-left separation is carried out also in an adjoining field (un-illustrating), and the stereoscopic vision field which can carry out stereoscopic vision exists.
[0011] Moreover, as a glasses-less three dimentional display method, there is a parallax barrier method other than the above-mentioned lenticular lens method. Hereafter, this PARAKKUSU barrier method is explained.
[0012] As for the solid image display method using a parallax barrier, the technique is indicated by S.H.Kaplan. (21 59 "Theory of Parallax Barriers", J.SMPTE, Vol. No. 7, pp.11- 1952) . By displaying the stripe image compounded from the parallax image on either side previously explained also in this method, and minding the slit (called a parallax barrier) which has predetermined opening prepared in the location which only a predetermined distance separated from this stripe image, an observer separates and observes the parallax image corresponding to each eye by the eye of each right and left, and acquires stereoscopic vision.
[0013] With such conventional equipment, it is this 2 like the usual television It was not able to be used as a dimension image display device.
[0014] Then, in JP,3-119889,A and JP,5-122733,A, a parallax barrier is electronically formed by a transparency mold liquid crystal device etc., and the solid image display device controls a configuration, a location, etc. of a parallax barrier electronically and it was made to change is indicated.
[0015] Drawing 17 is the important section schematic diagram of the solid image display device currently indicated by JP,3-119889,A. With this equipment, it is the image display side 101. Thickness d Spacer 102 Electronic formula parallax barrier 103 which minds and consists of a transparency mold liquid crystal display component It arranges. image display side 101 **** -- 2 the stripe image of the length constituted from a parallax image picturized a direction or from many -- displaying -- on the other hand -- electronic formula parallax barrier 103 **** -- XY address -- microcomputer 104 etc. -- by specifying by the control means, a parallax barrier is formed in the location of the arbitration on a barrier side, and stereoscopic vision is made possible according to the principle of said parallax barrier.
[0016] It sets to this equipment and is 2. In case dimension image display is performed, it is the electronic formula parallax barrier 103. It is 2 by stopping formation of a barrier stripe and changing into a transparent and colorless condition over the whole region of an image display field. Dimension image display is performed. Usual 2 which was not made by the solid image display method using the conventional parallax barrier by this Compatibility with a dimension image display device is realized.
[0017] Drawing 18 is the important section schematic diagram of the liquid crystal panel display currently indicated by JP,3-119889,A and the solid image display device constituted by the electronic formula barrier. With this solid image display device, it is 2. The liquid crystal layer 115 of **, and 125 It is 2, respectively. The polarizing plate 111 of **, and 118 121 And 128 It inserts and is the liquid crystal layer 115. An image display means and liquid crystal layer 125 It is made the configuration made into electronic formula barrier means forming.
[0018] It also sets to this equipment and is 2. In case dimension image display is performed, it is the liquid crystal layer 125. It is 2 by stopping formation of a barrier stripe and changing into a transparent and colorless condition over the whole region of an image display field. Dimension image display is performed and it is usual 2. Compatibility with a dimension image display device is realized.
[0019] Moreover, electronic formula parallax barrier 103 which changes from a transparency mold liquid crystal display component to JP,5-122733,A as shown in drawing 19 It considers as the configuration of arbitration which can make only a field generate the pattern of a barrier stripe in part, and is 3. A dimension image and 2 The example which made it possible to indicate the dimension image by mixture within the same screen is indicated.
[0020] The range which whose width of face of the field which can carry out stereoscopic vision is narrow, and can carry out stereoscopic vision of the observer in the solid display unit which constitutes and displays a stripe image like the lenticular lens method explained in the top or a parallax barrier method, and makes stereoscopic vision possible has only the one half of the width of face of about 65mm of both-eyes center distances at the maximum. Therefore, the observer needed to observe the location of the head, as it fixed, and he had the fault of it having been stabilized and being hard to carry out stereoscopic vision.
[0021] To it, in order to make the field of this stereoscopic vision large, the location of an observer's both eyes is detected, and the method which extends a stereoscopic vision field is proposed at JP,2-44995,A by carrying out migration control of the relative position of the longitudinal direction of a lenticular lens and a display

device according to this.
[0022] Moreover, in JP,2-50145,A, an observer's both-eyes location is detected, the location of right and left of the stripe pixel of the parallax image for right eyes corresponding to a lenticular lens and the parallax image for left eyes is replaced with the signal, and the method which makes a stereoscopic vision field large is proposed.
[0023] Here, the means which detects the location of an observer's both eyes and makes a stereoscopic vision field large is explained briefly. As a detection means of an observer's both-eyes location, an observer is arrested with a camera, the profile is extracted or the image-processing approaches, such as looking for an observer with pattern matching, are proposed.
[0024] Drawing 20 is the explanatory view of the principle which a lenticular lens is made to follow on the occasion of migration of an observer's longitudinal direction in a lenticular lens method. 400 in drawing It is an observer before a change and, for 400', an observer is distance a from a position to a longitudinal direction. It is a location when moving. 401 It is one cylindrical lens which constitutes a ** lenticular lens, and 401' follows a watcher and is this cylindrical lens after migration. b It is the movement magnitude of a cylindrical lens (= lenticular lens), and 402 at the time of ****. The display picture element part and f which display a right stripe pixel (black painting) and a left stripe pixel (void) The focal distance of a cylindrical lens, and S It is observation distance.
[0025] usually, the time of the relation of S>>f being realized -- an observer's longitudinal direction -- a if only following bb=f-a/S moves a lenticular lens to migration -- a stereoscopic vision field -- a longitudinal direction -- a only -- it moves.
[0026] In addition, although the example to which a lens is moved here was explained, it is the display picture element part 402. The same effectiveness is acquired even if it makes it move to a lenticular lens.
[0027] In the top, when an observer moved to a longitudinal direction to a solid display, the principle which a stereoscopic vision field is made to follow was explained. However, an observer may move not only in a longitudinal direction but in the depth direction to a solid display, and it may separate from him from a stereoscopic vision field in the depth direction depending on the case.
[0028] The proposal which solves this trouble in JP,4-122922,A is 3 lenticular. It is indicated by the method which indicates the dimension image by projection. By this proposal, the location of an observer's depth direction is also detected and stereoscopic vision flattery of the depth direction is also enabled at coincidence.
[0029] Two or more following approaches are indicated by above-mentioned JP,2-50145,A as a location detection means of an observer's longitudinal direction.
(a) Mainly floodlight infrared radiation and detect the return light.
(b) Project infrared light on an observer and it is Rhine-like CCD about the reflected light from an observer. It wins popularity and detects to image sensors.
(c) Project infrared radiation from an observer tooth back, and detect from the quantity of light distribution of an electric eye prepared in the front face.
(d) Perform profile extract processing from an observer's image with a TV camera, and an image recognition technique detects a both-eyes location further.
[0030] Moreover, two or more following means are indicated by above-mentioned JP,4-122922,A as a location detection means of the depth direction.
(a) It is a distance detector using infrared radiation 2 The **** approach for bases.
(b) 2 Approach by the image processing of the camera of a base.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Though it is simple structure by this invention's modulating and floodlighting infrared light on an observer's head by the above configuration or it detects the reflected light with two or more light-receiving means, and detecting the reflected light with the light-receiving means of a line sensor, processing the output appropriately, and detecting an observer's head location, a solid display unit with possible making a stereoscopic vision field follow a high speed is attained.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The following technical problems occurred in the above-mentioned conventional solid display unit.
[0032] (1) In what detects an observer's location by infrared light emitting/receiving, since distinction of the return light from an observer and noise light does not stick when there is a noise which otherwise generates infrared light according to an exposure and light-receiving of mere infrared radiation, it has a bad influence on detection precision and detection dependability.
[0033] (2) The observer was picturized with the camera etc., in the solid display unit which detects the observation location by the image processing, the huge operation was needed for detection, and high-speed detection became difficult, therefore the rate of flattery of a stereoscopic vision field became slow, and a satisfying slew rate was not able to be secured. Furthermore, since a high speed and a highly efficient calculation function were needed as equipment, there was a problem used as cost quantity.
[0034] The purpose of this invention is offer of a solid display unit with possible making a stereoscopic vision field follow a high speed, though it is simple structure by modulating and floodlighting infrared light on an observer's head or it detects the reflected light with two or more light-receiving means, detecting the reflected light with the light-receiving means of a line sensor, processing the output appropriately, and detecting an observer's head location.

[Translation done.]

MEANS

[Means for Solving the Problem] Solid display unit of this invention (1-1) The parallax image for right eyes and the parallax image for left eyes are divided into a stripe-like stripe pixel, respectively. The stripe image which puts these stripe pixels in order in predetermined sequence, and constitutes them is displayed on an image display means. In the solid display unit which a binocular parallax image is displayed [display unit] for the flux of light from this stripe image by deviation optical elements, such as a lenticular lens and a parallax barrier, and a predetermined stereoscopic vision field is formed [display unit], and makes an observer observe a stereoscopic model It has the head location detection means equipped with an infrared light floodlighting means to irradiate by the infrared light which modulated this observer, and a light-receiving means to receive alternatively the modulated this infrared light which this observer reflects. The means to which a stereoscopic vision field is moved based on this observer's head location which this head location detection means detects is characterized by making this stereoscopic vision field follow etc.
[0036] Especially (1-1-1), A means to make said stereoscopic vision field follow moves deviation optical elements, such as said lenticular lens or said parallax barrier, based on said observer's head location, and moves said stereoscopic vision field. .
(1-1-2) Said infrared light floodlighting means has a diaphragm means to restrict the floodlighting range of the vertical direction.
(1-1-3) Said infrared light floodlighting means or an infrared light light-receiving means has the adjustment device in which the direction of radiation or the light-receiving direction of said infrared light can be adjusted in a vertical plane.
(1-1-4) Said infrared light floodlighting means modulates the infrared light which this irradiates on a predetermined frequency, and said light-receiving means receives the infrared light which said observer reflects with a synchronous means synchronizing with this modulation.
(1-1-5) The modulation frequency of said infrared light floodlighting means is set up so that it may differ from the integral multiple of the display frequency of said image display means.
(1-1-6) In case the infrared light which said observer reflects is received with said light-receiving means, control the luminescence reinforcement of said infrared light luminescence means so that the amount of the infrared light which this light-receiving means receives becomes fixed.
(1-1-7) said head location detection means -- 2 said light-receiving means of ** -- horizontal -- detaching -- having -- this -- 2 from the difference of the output of the light-receiving means of ** -- this -- difference -- this -- 2 Said observer's head location is detected from the value which **(ed) by the output sum of the light-receiving means of **.
(1-1-8) Said light-receiving means is a line sensor which has arranged two or more pixels horizontally, carries out image formation of said observer's image on this line sensor, and detects this observer's head location based on the center-of-gravity location of this image detected from the signal from this line sensor.
(1-1-9) the signal from each pixel of said line sensor -- 2 a value-ized means -- a predetermined threshold -- 2 of high level or a low level a value -- changing -- this -- 2 If it is the high-level maximum width or negative logic of a signal value-ized, a width-of-face detection means will detect the maximum width of a low level, and let the center position be said observer's head location.
(1-1-10) Control the luminescence reinforcement of said infrared light floodlighting means according to the maximum or the integral value of a signal from each pixel of said line sensor.
(1-1-11) Control the amplification factor of the signal from this line sensor according to the maximum or the integral value of a signal from each pixel of said line sensor.

(1-1-12) Control said threshold according to the maximum or the integral value of an output from each pixel of said line sensor.
(1-1-13) Said detected high-level maximum width judges with a decision means whether it is less than the range of predetermined width of face, and updates said observer's head positional information at the time less than of the range of predetermined width of face.
(1-1-14) Judge with a decision means whether either of the both ends of said detected high-level maximum width is in agreement with the maximum of the detection range, or the minimum value, and when not in agreement, update said observer's head positional information. It is characterized by things etc.
[0037]
[Embodiment of the Invention] Drawing 1 Operation gestalt 1 of the solid display unit of ******** It is an external view. This operation gestalt is the solid display unit which used the lenticular lens method. drawing 7 from the following and drawing 1 using -- operation gestalt 1 ******** -- it explains.
[0038] Drawing 1 Inside and 500 It is the notation of this whole equipment. 600 It is the solid image display section using a ** lenticular lens method. 300 It is a ****** location detection sensor and is an infrared light floodlighting system. (infrared light floodlighting means) Light-receiving system (light-receiving means) It has and an observer's head location is detected. In addition, this head location detection sensor 300 It has the adjustment device, i.e., the include-angle adjustment device of the vertical direction, in which the direction of radiation and the light-receiving direction of infrared light of [within a vertical plane] can be adjusted according to an observer's physique. Drawing 2 ****** gestalt 1 It is the block diagram of a system. The inside of drawing, and 1 It is a lenticular lens (it calls for short that it is lenticular henceforth), and is the image display means 2. It receives and can move to a longitudinal direction. image display means 2 For example, a liquid crystal display component, a plasma display device, and CRT etc. -- it constitutes and the stripe image mentioned later is displayed.
[0039] 400 ******** and 300 The aforementioned head location detection sensor and 3 Head location detection sensor 300 from -- it is the head location detector which processes a signal. 4 It is the controller which controls the ****** gestalt 1 whole, and is the head location detector 3. The acquired head positional information is also inputted into this controller as one signal. 5 It is a ** sliding mechanism and is the specified quantity image display means 2 about a lenticular sheet 1. It receives and is made to move to a longitudinal direction. 6 ** sliding mechanism 5 It is the slide drive circuit to drive.
[0040] in addition, the head location detection sensor 300 and the head location detector 3 etc. -- an element of a head location detection means is constituted. moreover, a sliding mechanism 5 and the slide drive circuit 6 etc. -- an element of a means which a stereoscopic vision field is made to follow is constituted.
[0041] Drawing 3 ****** gestalt 1 Sliding mechanism 5 It is an explanatory view. inside of drawing, and 1a -- lenticular sheet 1 The pin prepared in one, and 1b, 1c, 1d and 1e are the mounting eyes of a spring. 10a 10b, 10c, and 10d Lenticular sheet 1 It is the parallel flat spring which presupposes only at a longitudinal direction that it is movable, and supports only predetermined spacing floating from a housing (un-illustrating).
[0042] 11 is 11a. Slot 11b which rotates as the center of rotation and which is a lever and was prepared in this Engaged lenticular sheet 1 Pin 1a is minded and it is a lenticular sheet 1. Migration control is carried out at right and left. 11c It is the sector gear prepared in a part of ** lever. The DC motor which is a source of power for 12 to rotate this lever, and 13 are sector gear 11c of a lever 11. He is a gearing for minding and making power transmit.
[0043] A permanent magnet for 14 to generate a field and 15 are the hall devices which detect the flux density of a magnet 14, and are a lenticular sheet 1. It is detected as a changed part of this magnetic flux, and movement magnitude is a lenticular sheet 1 based on this value. Feedback control of the amount of slides is carried out.
[0044] Drawing 4 ****** gestalt 1 Head location detection sensor 300 It is an important section perspective view. The infrared emitting diode (infrared rays LED) whose 20 are the light source for floodlighting, and 21 are the cylindrical lenses for irradiating the head above an observer's shoulder among drawing. B It is a diaphragm means to restrict the floodlighting range of the vertical direction of the exposure flux of light from ******. infrared LED 20, a cylindrical lens 21, and diaphragm means B etc. -- infrared light floodlighting system (infrared light floodlighting means) An element of 34 is constituted.
[0045] 22R 22L The condensing lens and 23R which condense the reflected light of the infrared light floodlighted to the observer 23L The infrared light transparency filter and 24R which shade except infrared light 24L It is the photo transistor which receives infrared light and is changed into an electrical signal. condensing

lens 22R, infrared light transparency filter 23R, and photo transistor 24R etc. -- right-hand side light-receiving system (light-receiving means) 30R an element -- constituting -- **** -- condensing lens 22L, infrared light transparency filter 23L, and photo transistor 24L etc. -- left-hand side light-receiving system (light-receiving means) 30L An element is constituted. In addition, R given to a notation in this specification And L It expresses that they are a right-hand side element and a left-hand side element, respectively.

[0046] Drawing 5 ****** location detection sensor 300 It is the explanatory view of a detection principle. the inside of drawing, and x The movement magnitude of the head from the center position (shaft of a sensor) of a sensor, and S Observer 400 from -- photo transistor 24R 24L distance with the connected line, and LL -- observer 400 from -- photo transistor 24L up to -- distance and LR -- observer 400 from -- photo transistor 24R up to -- distance and d They are a photo transistor and the distance based on sensors.

[0047] Drawing 6 In a **** operation gestalt, it is the output Fig. of a photo transistor for which the artificer asked experimentally. The inside of drawing and VR are photo transistor 24R. The output of photo transistor 24L and VP of an output and VL are the peaks of an output value. these outputs -- observer 400 from -- the location of the shortest [distance / LR and LL / to a photo transistor], i.e., the location as for which an observer does a right pair to each photo transistor, i.e., x=d, And it becomes max in the location of x=-d. According to experimental data, since the output of each photo transistor serves as a quadratic curve in approximation near the maximum, alpha, then each output are expressed as VR=VP-alpha (x-d) 2 VL=VP-alpha (x+d) 2 in the synthetic parameter of the optical system of a photo transistor, or an electric system. If these differences are taken, it is set to VR-VL=4dalphax and is an observer's migration length x. 2 It turns out that the output difference of the photo detector of ** is in proportionality.

[0048] moreover, the relation explained by drawing 20 of the conventional example -- x=a it is -- since -- lenticular sheet 1 for making a stereoscopic vision field follow migration of an observer's longitudinal direction Movement magnitude b Lenticular sheet 1 the focal distance of the cylindrical lens to constitute -- f ** -- it carries out and becomes b=f(VR-VL)/(4dalphaS).

[0049] Drawing 7 ****** gestalt 1 It is a block diagram showing the flow of a signal. This explains the flow of processing of the operation gestalt 1. Inside of drawing, and 30R 30L It is the right-hand side light-receiving system and left-hand side light-receiving system which were explained above. 31R 31L Pre amplifier and 32R which carry out alternating current amplification of the signal from each light-receiving system to a suitable output 32L The rectifier circuit and 33R which rectify the AC signal from each pre amplifier 33L It is the low pass filter which graduates the signal rectified in each rectifier circuit.

[0050] For 34, the infrared light floodlighting system explained above and 35 are infrared rays LED by the predetermined control signal. LED which controls and drives luminescence timing and luminescence reinforcement It is a driver. 36 is OSC. for a modulation, modulates floodlighting light on a predetermined frequency, and removes the effect of disturbance light other than infrared light floodlighting systems, such as an indoor fluorescent lamp. The signal for this modulation has removed the effect of disturbance light by supplying and synchronizing in an infrared light floodlighting system and pre amplifier 31R and 31L. Moreover, this modulation frequency is the image display means 2. It sets up so that it may differ from the integral multiple of a display frequency, and effect from image display is made small. in addition, the object for a modulation -- OSC.36 and LED A driver 35, pre amplifier, etc. constitute an element of a synchronous means. low pass filter 33R equivalent to the output VR which explained 37 above from -- low pass filter 33L equivalent to a signal and an output VL from -- it is the subtractor which calculates the difference of a signal and this value shows an observer's head location.

[0051] 38 -- low pass filter 33R 33L from -- it is the adder which asks for the sum of the value of a signal, and this value represents the reinforcement of the quantity of light which has reached the observer.

[0052] the quantity of light predetermined in 39, and the output of the quantity of light calculated with the adder 38 -- the subtractor for calculating difference and 40 are the quantity of light error amplifier for amplifying the difference of the quantity of light. It is through LED about a subtractor 39 and the quantity of light error amplifier 40 so that the value of an adder 38 may always become fixed with this operation gestalt. Feedback is hung on a driver 35. Thereby, it is drawing 6. Head location x Output V The output which relation became the same almost always and was stabilized comes to be obtained. Furthermore, (VR-VL)/(VR+VL) By calculating, the stable output is obtained further.

[0053] 41 is an observer's head position signal and lenticular sheet 1 which were obtained from the subtractor 37. It is the tuning amplifier for taking adjustment with the signal for carrying out movable. The power

amplification constituted from a power transistor etc. in order that a subtractor for 42 to constitute the feedback control system of a sliding mechanism and 43 might carry out the signal of a subtractor 42 and magnification or the servo error amplifier for finding the integral or differentiating, and 44 might carry out power amplification of the signal of the servo error amplifier 43, and 45 are drawing 3. It is a sliding mechanism and is a lenticular sheet 1. It is made to move. 46 is drawing 3. It is a permanent magnet 14 and the lenticular location sensor which added the electronic circuitry for detection to the hall device 15, and is a lenticular sheet 1. A location is detected.

[0054] such an equipment configuration -- setting -- observation distance S a basis -- the movement magnitude x of an observer's head location -- asking -- lenticular sheet 1 b only -- if it is made to move, a stereoscopic vision field can be made to follow synchronizing with migration of an observer

[0055] According to this operation gestalt, it is possible to face to detect an observer's head location, to remove the effect of disturbance light compared with the approach by the conventional image processing, and to detect the location at a high speed more with a simple configuration.

[0056] next, operation gestalt 2 ******** -- it explains. operation gestalt 1 **** -- the return luminous intensity of infrared light -- detecting -- an observer's migration length x Since it asked, detection might become unstable with a difference and observation distance of an observer's reflection factor. Operation gestalt 2 This trouble is canceled.

[0057] Operation gestalt 2 It sets, infrared radiation is projected on an observer's head, image formation of an observer's image is carried out to a line sensor using that return light, an observer's head location is detected from the profile of the observer head on it, and it is this head location. (observation location) To a basis, it is a lenticular sheet 1. It is made to slide to a longitudinal direction mechanically, and a stereoscopic vision field is followed. In addition, operation gestalt 2 A line sensor is a charge-coupled device (CCD) which has arranged two or more pixels horizontally. It uses.

[0058] Drawing 8 Operation gestalt 2 of the solid display unit of ******** It is the important section perspective view of the head location detection sensor 300. 20 The inside of drawing, and 21 B It is the same infrared emitting diode as the operation gestalt 1, a cylindrical lens, and a diaphragm means, and the floodlighting system B1 is constituted. The light-receiving lens to which image formation of an observer's image which 50 floodlighted infrared light and was illuminated is carried out, the infrared light transparency filter with which 51 shades except infrared light, and 52 are the line sensors formed at a level with the image formation location of the light-receiving lens 50, by the circuit for read-out, measure the strength of the light and change the single dimension light-receiving reinforcement of the longitudinal direction of a sensor into an electric signal. In addition, a lens 50, the infrared light transparency filter 51, and line sensor 52 grade are a light-receiving system. (light-receiving means) An element of B-2 is constituted.

[0059] Drawing 9 ****** gestalt 2 Head location detection sensor 300 It is the explanatory view of a detection principle. Operation gestalt 1 He is an observer 400 similarly. Infrared rays LED 20 It is illuminated by the cylindrical lens 21. Only the light-receiving system is illustrated in this Fig. Observer 400 illuminated by the infrared light floodlighting system Image formation of the image is carried out on a line sensor 52 with a lens 50. Since an observer's part which carried out image formation on the line sensor 52 has brightness higher than other parts, if this part is detected and a center of gravity is calculated, an observer's head location will be obtained.

[0060] The procedure below an outline performs detection of this observer's head location.

** Project infrared light on an observer head.

** Carry out image formation of an observer's head image on a line sensor through an infrared transparency filter.

** Amplify the analog signal of a line sensor to proper level.

** About the analog signal of the amplified line sensor, it is high level somewhat from a background noise. (threshold) It compares and is 2. It changes into a value-ized signal. Here, since the part with high-level level is a part near a sensor (display), it can be considered that it is an observer.

** 2 The value-ized high-level width of face is detected, and the width of face considers as an observer's head location in quest of the center position of the high-level maximum width by using the largest part as an observer head.

** Head location data which will have been memorized in equipment if the dependability of the above-mentioned count is checked and predetermined conditions are fulfilled (head positional information) It updates.

Moreover, linearity amendment is performed if needed.
** Transmit the obtained observer location data to the servo-system circuit to which a lenticular sheet is made to slide.
[0061] Following and operation gestalt 2 Order is explained for an operation later on. Drawing 10 is a head location detection value and a lenticular sheet 1. It is the explanatory view of the relation of the amount of slides. And drawing 10 (A) Head location detection sensor 300 An operation explanatory view and drawing 10 (B) Lenticular sheet 1 It is the explanatory view of movement magnitude. the inside of drawing, and SD -- the distance from an observer to the lens 50 of a head location detection sensor, and 400' -- the observer location after migration, and SD' the distance from the observer after migration to a lens 50, and fD -- the focal distance of a lens 50, and thetaD Observer 400 the straight line which connects the principal point of a lens 50 -- the datum line (optical axis of a light-receiving system) The include angle to make and xD are head detection locations which a line sensor 52 detects.
[0062] Drawing 10 (B) Setting, 1L is a lenticular sheet 1. One cylindrical lens and f to constitute The focal distance, SL, and SL' of this cylindrical lens The distance from an image display means to an observer, and b Lenticular sheet 1 Movement magnitude and thetaL It is the include angle of the line and the datum line which connect the principal point of cylindrical-lens 1L to an observer to make.
[0063] Drawing 10 (A) He is an observer 400, if it sets and the depth of field of a lens 50 are enough. Regardless of a location, it is thetaD. The relation of xD turns into proportionality.
[0064] Moreover, drawing 10 (B) He is an observer 400 then. Regardless of distance, it is thetaL. b Relation is in proportionality. In one solid display unit, it is thetaD. thetaL Since it becomes the same value, it is xD and the lenticular sheet 1 of a head location detection value. The amount b of slides Since what is necessary is just to make it proportionality, it is the amount b of slides based on the detection value xD regardless of an observer's distance. It is controlling and flattery of a stereoscopic vision field can be realized.
[0065] Drawing 11 is the operation gestalt 2. It is the block diagram showing the whole configuration. the inside of drawing, and B1 -- a floodlighting system -- it is -- infrared rays LED -- it consists of a cylindrical lens 21 which extracts 20 and this infrared light to the flux of light of the shape of a beam long in a longitudinal direction, and is driving by the predetermined approach. B-2 is a light-receiving system and consists of a line sensor 52 which changes the image by which image formation was carried out to the light-receiving lens 50 for carrying out image formation of the infrared (IR) filter 51 and an observer's head image which penetrate the illuminated return light from an observer into an electrical signal.
[0066] this line sensor -- charge-coupled device (CCD) it is -- since -- since this line sensor 52 is driven -- 1 of detection microcomputer B4 to a line sensor The shift pulse which determines a scan time, and oscillator B11 from -- counting-down circuit B12 It minds, the clock for a line sensor drive and the clock for data read-out are supplied, and the luminance signal of each pixel is outputted with an analog quantity.
[0067] B3 -- 2 Value-ized processor (2 value-ized means) it is -- amplifier B14 which amplifies the analog signal acquired from the line sensor 52 to a suitable value with a certain amplification factor a certain threshold -- comparing -- 2 of high level or a low level Comparator B15 changed into a value from -- it has become. B4 is a detection microcomputer and is 2. The signal from the value-ized processor B3 is received, and it is count of an observer's location, and 2. It processes transmitting the dependability check of a value-ized signal or a count result, and count data to servo microcomputer B5 etc.
[0068] B5 is the desirable lenticular sheet 1 for being a servo microcomputer, receiving observer location data from detection microcomputer B4, and making a stereoscopic vision field follow from this. A location is converted, a controlled variable is calculated as compared with the lenticular positional information from lenticular location sensor B6, and it is Motor Driver B54 of the slide drive system B7 about this. It outputs.
[0069] the slide drive system B7 -- drawing 3 Sliding mechanism B55 which consists of the lenticular slide support device and lenticular motor which were explained, a moderation gear, etc. Motor Driver B54 etc. -- it has, and a lenticular right-and-left location is controlled in response to the control signal from servo microcomputer B5, and a stereoscopic vision field is made to follow to an observer location
[0070] It sets to drawing 11 and is an oscillator B11. While supplying a basic clock to microcomputer B4 for detection, it is a counting-down circuit B12 about the same basic clock. The formed clock which supplies and carries out dividing is supplied to the line sensor 52. Moreover, 1 of a line sensor 52 The software of detection microcomputer B4 generates the shift pulse which determines a scan time, it is outputted to a line sensor 52, and is controlling this. It is the amplifier B14 with which this signal performs subtraction and magnification since

the analog signal from a line sensor 52 is feeble and a part for direct-current bias is included. It amplifies to suitable level. It is a comparator B15 about this amplified signal. It compares with a certain threshold and is 2. It is inputted into detection microcomputer B4 as a value-ized signal, and an observer's head location is detected here.

[0071] Moreover, it is DA converter B16 from detection microcomputer B4. A signal is taken out and it is the drive circuit B17. It minds and they are infrared rays LED 20. Luminescence reinforcement is controlled and an observer's exposure reinforcement is controlled appropriately.

[0072] In an observer's location detection, it is the floodlighting system B1 in the block diagram of drawing 11, light-receiving system B-2, and 2. Although the value-ized processor B3, detection microcomputer B4, etc. are related, the software processing inside detection microcomputer B4 is mainly explained here.

[0073] Drawing 12 is the flow chart of the program performed inside detection microcomputer B4. This is explained.

[0074] Step S1 is a step which sets up the input/output port of a microcomputer etc., and is 2. It is 2 by the value-ized processor. A setup of the input port of the value-ized signal is also performed here. At step S2, it is 1 of a line sensor. The shift pulse which reads with a scan time and determines start time is generated. Step S3 is a step which carries out the standby to the read-out location on the line sensor to which the image is connected optically. It is the brightness signal of an object including the observer whom a line sensor 52 outputs in step S4 1 Pixel [every] sequential incorporation and its 2 It is the step which asks for the high-level width of face of the value-ized output one by one, and asks for the high-level maximum width and its location. (Processing of this step is explained independently.) Step S5 is a step which verifies the dependability of the maximum width and calculates an observer's location (core of a pulse) from the high-level width of face and the high-level location which were obtained. (Processing of this step is explained independently.) Step S6 is a step which carries out linearity amendment of the nonlinear part (both ends) of a sensor output. Step S7 is a step which transmits an observer's obtained location data to the servo circuit containing servo microcomputer B5. Step S8 is based on the output of the line sensor 52 detected now, and they are infrared rays LED 20. It is the step which controls luminescence reinforcement. Step S9 detects an observer's location next, is standby until it corresponds to this, will progress again after predetermined time at step S2, and will constitute an endless loop from a step S2 between S9.

[0075] Drawing 13 is 2 performed by step S4 in detection microcomputer B4 explained by drawing 12. It is the flow chart of the program which asks for the high-level maximum width of a value-ized output. This is explained.

[0076] Step S4a It is the register used by this routine compulsorily 0 It is the step to clear. The register used here is the count of this loop formation, i.e., the read-out location on a line sensor. (address) Shown Count A register and Width which stores high-level width of face temporarily LastAdd which stores the address of the termination of a register, the WidthMax register which updates and stores the maximum of high-level width of face, and WidthMax It consists of a register. 8 bits consists of these operation gestalten for these registers as one unit. moreover, a detection span -- Count a register -- 0 from -- it has prepared so that 255 may be taken. [0077] Step S4b Count of a line sensor 52 It is 2 from the input port of the microcomputer which set up the output from the pixel of the address specified with a register at step S1. It is the step read as a value-ized output. Step S4c This 2 It is the step which judges whether it is [output / which was value-ized] high-level in a low level. Step S4d It is Width then. A register is increased +one. Step S4e It will be step S4f, if it is the step which calculates (WidthMax-Width) and judges that positive/negative and this value serves as negative. A WidthMax register is updated. Step S4g The termination value of a WidthMax register (LastAdd value of a register) It is the step to update.

[0078] Step S4i Count It is the step to increase +one about a register. Step S4j Count A register is overflow, 255 [i.e.,]. It is the step which judges whether it exceeded or not.

[0079] Step S4k 2 It is Width when the value-ized output is a low level. It is the step which clears a register. Step S4h S4m S4n It is the step of the delay which wastes predetermined time amount, respectively and arranges the processing time of each loop formation.

[0080] As flow of this routine, it is Count. A register is 255. It is decision step S4c until it overflows. S4e Following 3 In accordance with the loop formation of a passage, it turns around a loop formation in this routine, and processing progresses. Moreover, step S4h S4m S4n This 3 It is the time delay step prepared so that the processing time of the loop formation of ** might be made the same.

[0081] ** step S4b ->S4c ->S4d ->S4e ->S4f ->S4g ->S4h ->S4i ->S4j from -- S4b Returning loop formation. Order is explained for this loop formation later on. Step S4b 1 incorporated from the line sensor 52 2 of a pixel A value-ized output is step S4c. It is step S4d if it is judged that it is high-level. Width Numeric value of a register Step S4e after increasing one It sets and is Width. The size relation of the numeric value of a register and a WidthMax register is compared.
[0082] It is Width here. It is step S4f if the value of a register is larger than the value of a WidthMax register. It is current Width spontaneously. The value of a register is stored in a WidthMax register and a numeric value is updated. Furthermore, step S4g It sets and is LastAdd. It is the present Count about the numeric value of a register. It updates with the value of a register. Subsequently, step S4h Elapsed time is adjusted and it is step S4i. It progresses. Step S4i It is Count of the address count on a line sensor then. +1 is added to a register and one is advanced to it. Subsequently, step S4j Count It is 255 when the value of a register is the number of pixels, i.e., now. It is step S4b, supposing it judges whether it overflowed or not and is not overflowing. It returns and the above-mentioned processing is performed about the following pixel.
[0083] In addition, Count If the value of a register is overflowing the number of pixels, it will finish processing of S4 and will progress to step S5.
[0084] ** step S4b ->S4c ->S4d ->S4e ->S4n ->S4i ->S4j from -- S4b Returning loop formation. Step S4b ->S4c ->S4d ->S4e Processing of until is the same as above **. Step S4e Width It is step S4n if the value of a register is smaller than the value of a WidthMax register. They are a WidthMax register and LastAdd spontaneously. It passes through adjustment of the processing time, without updating a register, and is step S4i. It progresses. step S4i ->S4j from -- S4b The returning processing is the same as above **.
[0085] ** step S4b ->S4c ->S4k ->S4m ->S4i ->S4j from -- S4b Returning loop formation. Step S4c One pixel in a line sensor (Count the address is specified with the register) 2 If a value-ized output is judged to be a low level step S4k Width which progresses and shows high-level width of face a register -- a clearance -- carrying out -- step S4m pass adjustment of the processing time -- step S4i progressing -- henceforth -- the above-mentioned step S4i ->S4j from -- S4b Returning processing is performed.
[0086] If step S4 shown in drawing 13 is processed, for the high-level maximum width, the address position of the termination of a WidthMax register is LastAdd to a WidthMax register. It is stored in a register. In addition, detection microcomputer B4 etc. constitutes an element of a width-of-face detection means which detects the high-level maximum width.
[0087] Drawing 14 is the flow chart of processing of step S5 in drawing 12. Here, it is step 4. The obtained high-level maximum width (WidthMax register) The address position of termination (LastAdd register) Dependability is verified and it is an observer's location. (head positional information) It calculates and is PosObs about the location. It stores in a register. In addition, Width-H in drawing The upper limit of WidthMax, and Width-L It is the lower limit of WidthMax.
[0088] It sets to drawing 14 and is step S5a. The start edge of the high-level maximum width is the start edge on a line sensor. (minimum value of the detection range) It judges whether it is in agreement. Here, WidthMax-(LastAdd+1) is 0. It confirms whether become or not and is 0. If it becomes, since the maximum width of a high-level pulse is restricted at the starting point of a line sensor 52 (it is missing), it judges that this acquired value is unreliable, and it progresses to the following step S6, without carrying out count and renewal of an observer's location. It is 0. If it does not come out, it is step S5b. It progresses.
[0089] Step S5b The termination of the high-level maximum width is the termination on a line sensor. (maximum of the detection range) It judges whether it is in agreement. Here, it is LastAdd+1. 0 It confirms whether become or not. It is 0. If it becomes, since the termination of the high-level maximum width is in agreement with the termination on a line sensor and the maximum width of a high-level pulse is restricted at the terminal point of a line sensor (it is missing), it judges that this acquired value is unreliable, and it progresses to the following step S6, without carrying out count and renewal of an observer's location. It is 0. If it does not come out, it is step S5c. It progresses.
[0090] Step S5c The value of a WidthMax register is Width-H of a upper limit. It is the step which confirms whether exceed or not, and if it seems that a upper limit is exceeded, it will progress to the following step S6, without carrying out count and renewal of an observer's location. If a upper limit is not exceeded, it progresses to step S5d.
[0091] It is Width-H of a upper limit here. In the range of this operation gestalt which can be followed, the value equivalent to width of face when an observer's head is the nearest, and the width of face which added

some margins is set up beforehand.
[0092] Step S 5d The value of a WidthMax register is Width-L of a lower limit. It is the step which confirms whether it is small, and if it seems that it turns around a lower limit the bottom, it will progress to the following step S6, without carrying out count and renewal of an observer's location. If a lower limit is not exceeded, it is step S5e. It progresses.
[0093] It is Width-L of a lower limit here. In the range of this operation gestalt which can be followed, the value equivalent to width of face when an observer's head is the furthest, and the width of face which lengthened some margins is set up beforehand. Step S5c And step S5d The high-level maximum width is the step which judges whether it is less than predetermined width of face.
[0094] Step S5e It is the step which asks for a high-level center position, and it asks by the operation of LastAdd-WidthMax/2, and the result is stored in PosObs as an observer's location. The above is processing of step S5. In addition, detection microcomputer B4 etc. constitutes an element of a decision means.
[0095] The output signal of 52 is 2 from a line sensor as mentioned above. It sets to the value-ized processor B3, and is 2 of high level or a low level at a predetermined threshold. It changes into a value-ized signal. However, if the distance of an observer's depth direction differs, the output values of a line sensor differ. That is, if an observer is far, the output of a line sensor 52 will become small, and it is a predetermined threshold The circumference of the bottom, and exact 2 A value-ized signal may not no longer be acquired.
[0096] For this reason, when the output of a line sensor 52 is small, they are infrared rays LED 20. It is necessary to raise luminescence reinforcement and to raise the output of a line sensor 52. It is AD converter B16 so that detection microcomputer B4 may investigate the integral value (total) or maximum output value of an output of a line sensor and this may become fixed with this operation gestalt. And drive circuit B17 It minds and they are infrared rays. 2 which controlled the luminescence reinforcement of LED20 and was stabilized It can be made to perform value-ized processing.
[0097] In addition, in addition to this, it is the amplifier B14 of the output signal of a line sensor 52. Control gain or it is 2. Change the threshold of value-ized processing or it is these 2. 2 similarly stabilized even by even combining two or more means of value-ized stability Value-ized processing can be performed.
[0098] Next, lenticular sheet 1 of this operation gestalt Drawing 11 explains the operation which controls a location by the servo-system circuit. A servo-system circuit is controlled by servo microcomputer B5 of drawing 11. This servo microcomputer B5 is the desirable lenticular sheet 1 which forms a stereoscopic vision field for observer location data from detection microcomputer B4 reception and after this corresponding to an observer's location. It converts and asks for a location. Lenticular sheet 1 The electrical-potential-difference value is changed into digital value by the AD converter built in servo microcomputer B5 by the current position being changed into an electrical potential difference by lenticular location sensor B6, such as a potentiometer or a hall device, and it is the desirable lenticular sheet 1. Difference with a location is calculated and it is a lenticular sheet 1. It is Motor Driver B54 about a controlled variable. It outputs. Motor Driver B54 Sliding mechanism B55 It drives and is a lenticular sheet 1. It is made to move to a desirable location and a stereoscopic vision field is made to follow an observer's location. in addition, the time of this actuation -- oscillator B51 from -- a clock is supplied to servo microcomputer B5 and timing is taken.
[0099] thus, the servo microcomputer B5-> Motor Driver B54 -> sliding mechanism B55 -- making -> lenticular sheet 1 -> lenticular location sensor B6-> servo microcomputer B5 and one loop formation -- lenticular sheet 1 Migration control is performed.
[0100] Drawing 15 is the flow chart of the program performed inside servo microcomputer B5. Step S51 It is the step which sets up the input/output port of a microcomputer etc., and a setup of the input port of an observation location is also performed from detection microcomputer B4 here.
[0101] Step S52 Lenticular sheet 1 Lenticular sheet 1 which is a location entry-of-data step and is outputted from lenticular location sensor B6 A position signal is inputted into the AD converter built in servo microcomputer B5, and it is the lenticular sheet 1 as digital value. Location data are obtained.
[0102] Step S53 It is the input step of the desirable lenticular location of **, an observer's location data are inputted from detection microcomputer B4, and it is the desirable lenticular sheet 1. It is the step converted into location data.
[0103] Step S54 Obtained desirable lenticular sheet 1 Location data and current lenticular sheet 1 PID which takes the difference of location data and carries out the load of the property of a proportional element (P-action), an integral element (integral action), or a derivative element (D action) if needed It is a count step and the

controlled variable to need is calculated.
[0104] Step S55 PWM It is the step of an output and is step S54. Based on the obtained controlled variable, the duty of the pulse of the electrical potential difference impressed to a motor is changed, and it is a lenticular sheet 1. It is made to move. This step S55 After finishing, it is step S52. A return endless loop is made.
[0105] Operation gestalt 2 Although modulated and floodlighted infrared light on an observer's head, the reflected light was detected with the light-receiving means of a line sensor, the output was processed appropriately and an observer's head location is detected, since the line sensor which has a sensitivity profile in a horizontal chisel in that case was used, the image processing of an observer's vertical direction can be omitted, the amount of operations can be lessened, and a stereoscopic vision field can be made to follow a high speed with simple structure.
[0106] In addition, although each above operation gestalt was the solid display unit of a lenticular lens method, also in the solid display unit which displays a binocular parallax image using deviation optical elements, such as a parallax barrier method, it is possible to detect an observer's head location with the same configuration as the above operation gestalt fundamentally, to move this parallax barrier etc. based on this observer's head location, and to move a stereoscopic vision field.

[Translation done.]

DESCRIPTION OF DRAWINGS

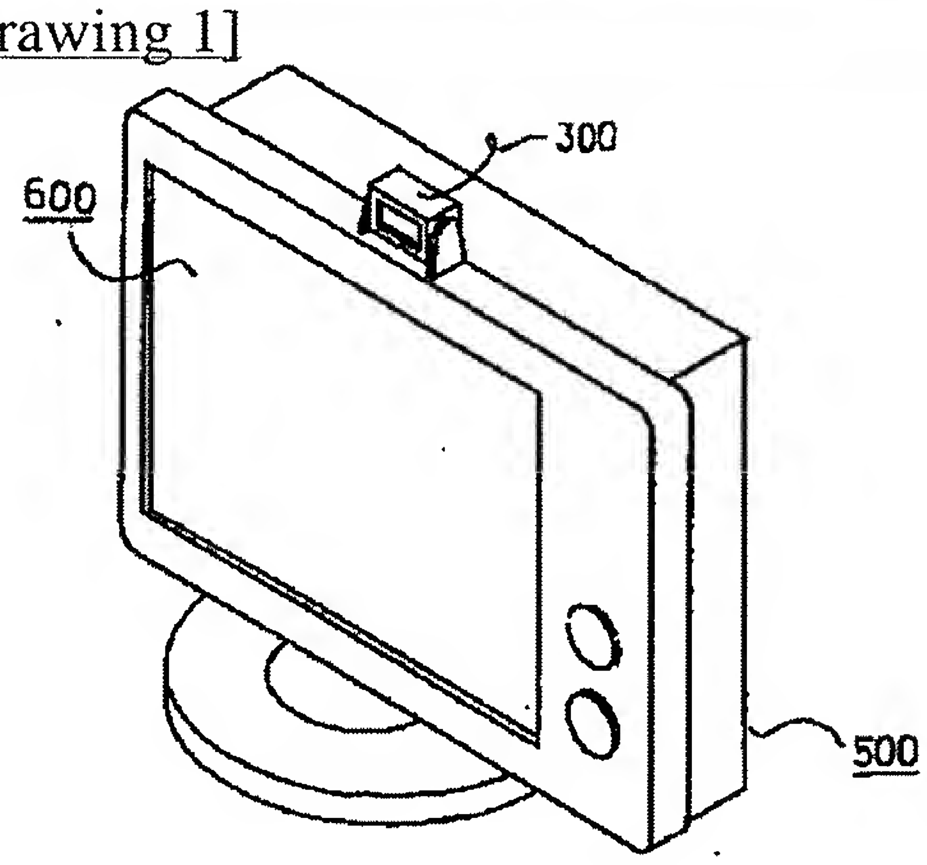
[Brief Description of the Drawings]
[Drawing 1] Operation gestalt 1 of the solid display unit of this invention External view
[Drawing 2] Operation gestalt 1 Block diagram of a system
[Drawing 3] Operation gestalt 1 Explanatory view of a sliding mechanism
[Drawing 4] Operation gestalt 1 Important section perspective view of a head location detection sensor
[Drawing 5] Operation gestalt 1 Explanatory view of the detection principle of a head location detection sensor
[Drawing 6] Operation gestalt 1 Output Fig. of a photo transistor for which was set and it asked experimentally
[Drawing 7] Operation gestalt 1 Block diagram showing the flow of a signal
[Drawing 8] Operation gestalt 2 of the solid display unit of this invention Head location detection sensor 300 Important section perspective view
[Drawing 9] Operation gestalt 2 Head location detection sensor 300 Explanatory view of a detection principle
[Drawing 10] Operation gestalt 2 Explanatory view of the relation between a head location detection value and the lenticular amount of slides
[Drawing 11] Operation gestalt 2 Block diagram of a whole configuration
[Drawing 12] The flow chart of the program performed inside a detection microcomputer
[Drawing 13] It is 2 at step S4. Flow chart of the program which asks for the high-level maximum width of a value-ized output
[Drawing 14] The flow chart of the program which verifies dependability at step S5
[Drawing 15] The flow chart of the program performed inside a servo microcomputer
[Drawing 16] The explanatory view of the conventional lenticular lens method
[Drawing 17] The important section schematic diagram of the solid image display device of JP,3-119889,A
[Drawing 18] The important section schematic diagram of the display of the solid image display device of JP,3-119889,A
[Drawing 19] Conventional 2 A dimension image and 3 Explanatory view of the solid image display device which indicates the dimension image by mixture.
[Drawing 20] The explanatory view of the principle which follows an observer in the conventional lenticular lens method at a longitudinal direction
[Description of Notations]
1 Lenticular Lens B Diaphragm
2 Image Display Means B1 Floodlighting System
3 Head Location Detector B-2 Light-receiving System
4 Controller B3 2 Value-ized Processor
5 Sliding-Mechanism Section B4 Detection Microcomputer
6 Slide Drive Circuit B5 Servo Microcomputer
10 Parallel Flat Spring B6 Lenticular Location Sensor
11 Lever B11 Oscillator
12 DC Motor B12 Counting-down Circuit
13 Gearing B14 Amplifier
14 Permanent Magnet B15 Comparator
15 Hall Device B16 DA Converter
20 Infrared Emitting Diode (Infrared Rays LED) B17 Drive Circuit
21 Cylindrical Lens B51 Oscillator

22 Condensing Lens B54 Motor Driver
23 Infrared Light Transparency Filter B55 Sliding Mechanism
24 Photo Transistor
30 Light-receiving System
31 Pre Amplifier
32 Rectifier Circuit
33 Low Pass Filter
34 Infrared Light Floodlighting System
35 LED Driver
36 OSC for Modulation
37 Subtractor
38 Adder
39 Subtractor
40 Quantity of Light Error Amplifier
41 Tuning Amplifier
42 Subtractor
43 Servo Error Amplifier
44 Power Amplification
45 Sliding Mechanism
46 Slide Position Detection Section
50 Light-receiving Lens
51 Infrared Light Transparency Filter
52 Line Sensor
101 Image Display Side
102 Spacer
103 Electronic Para Lack Barrier
104 Microcomputer
115,125 Liquid crystal layer
111,118,121,128 Polarizing plate
151 Liquid Crystal Display
152,154 Glass substrate
153 Display Picture Element Part
155 Lenticular Lens
156 Stereoscopic Vision Field
300 Head Location Detection Sensor
400 Observer
401 Cylindrical Lens
402 Display Image Section
500 This Equipment Whole
600 Solid Image Display Section

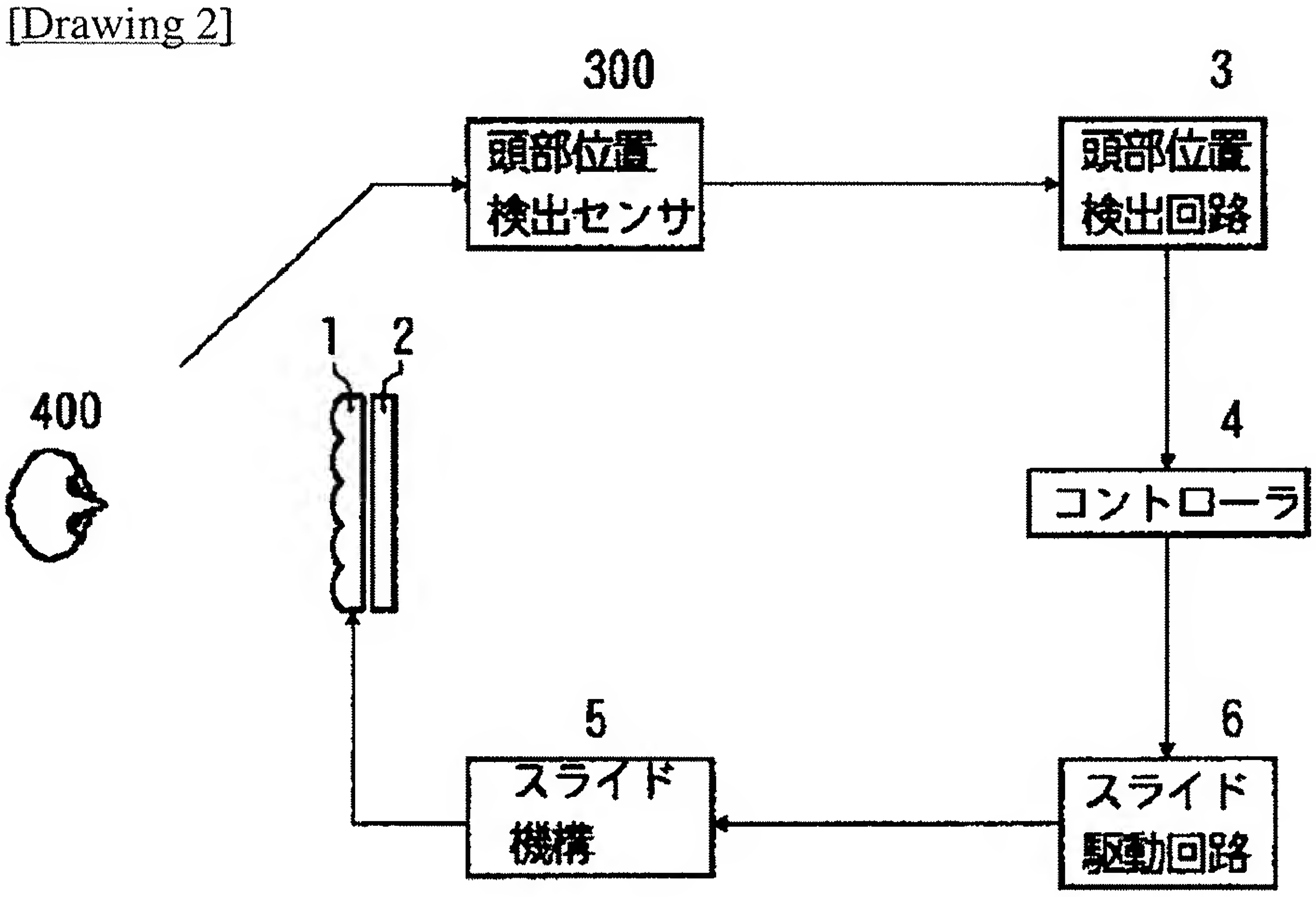
[Translation done.]

DRAWINGS

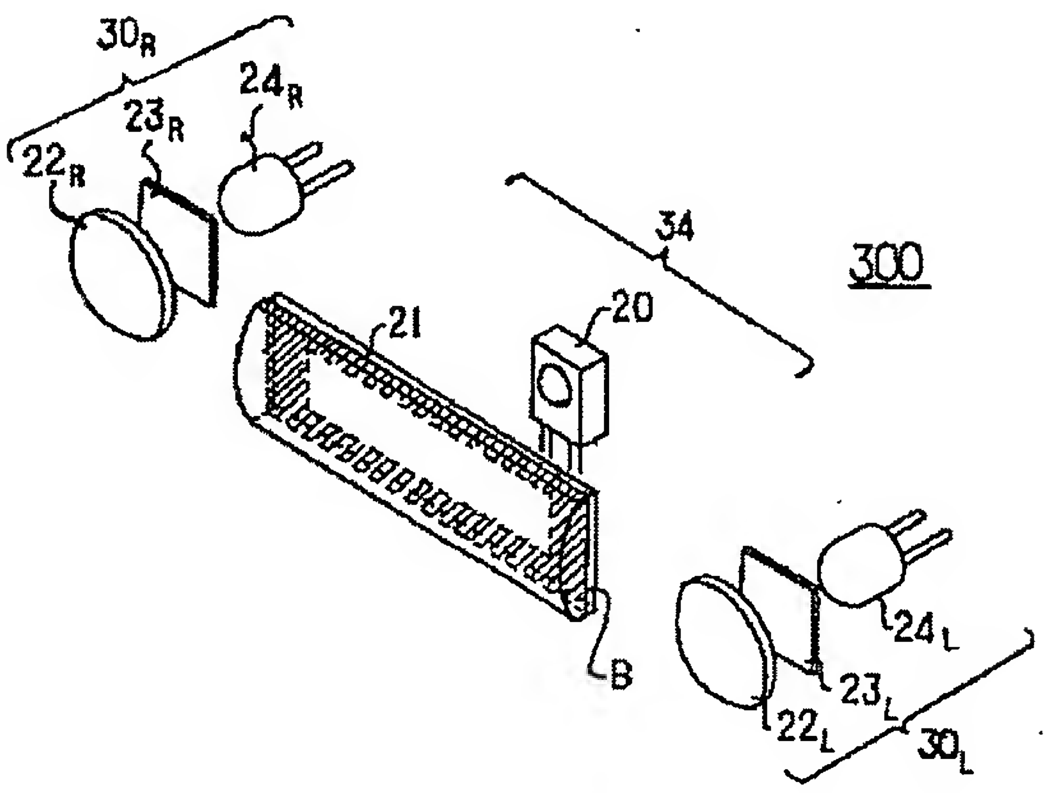
[Drawing 1]



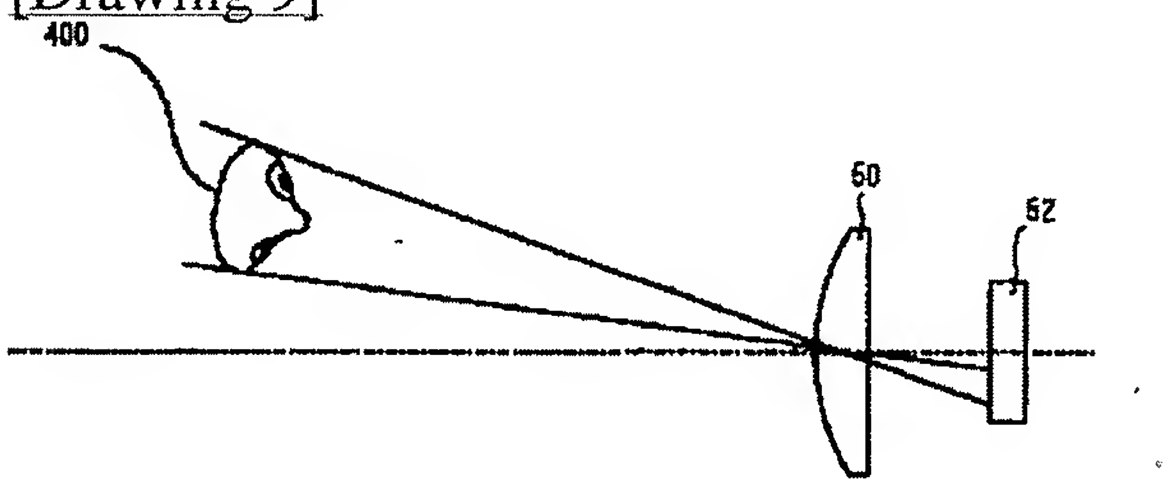
[Drawing 2]



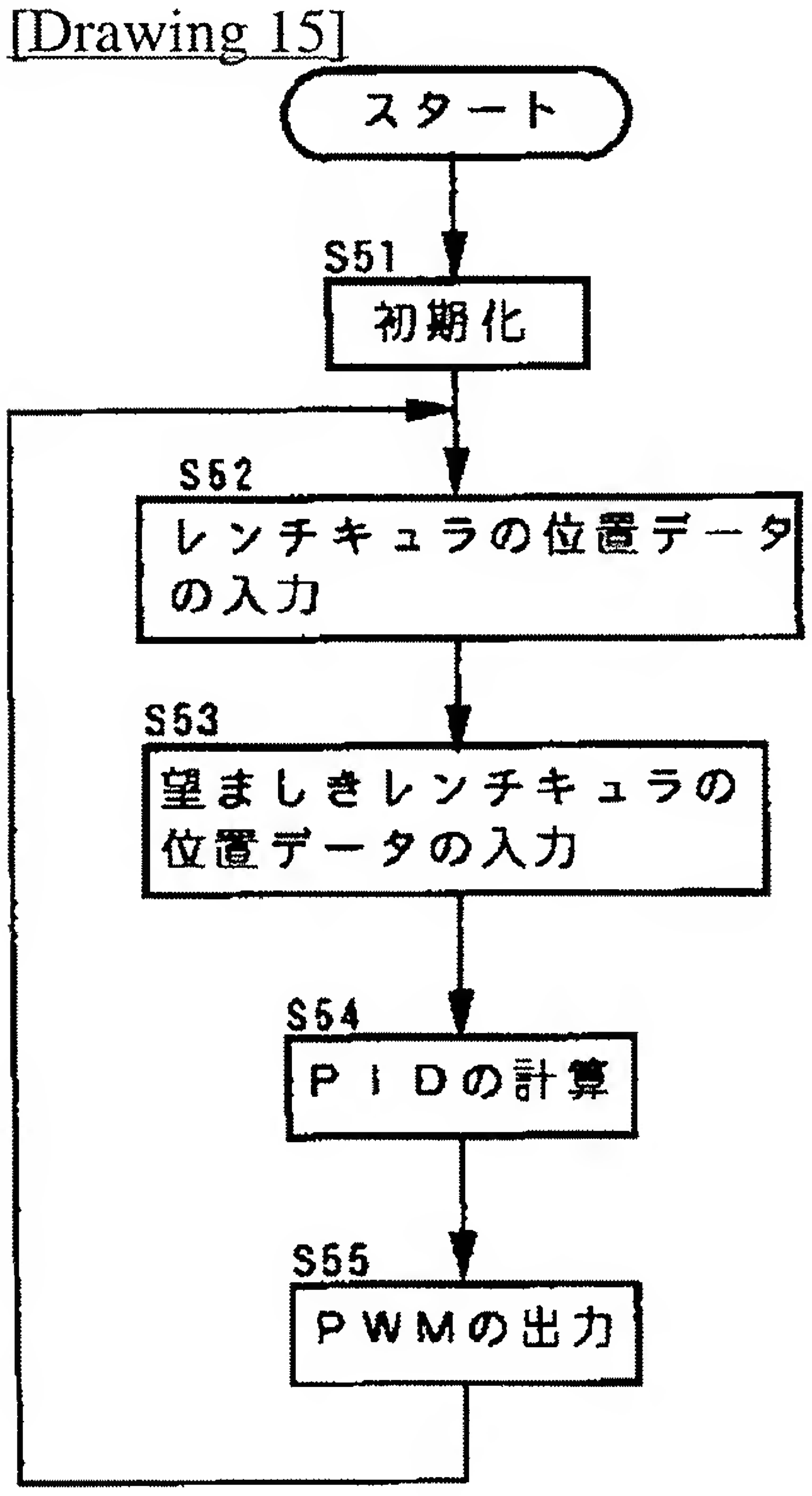
[Drawing 4]



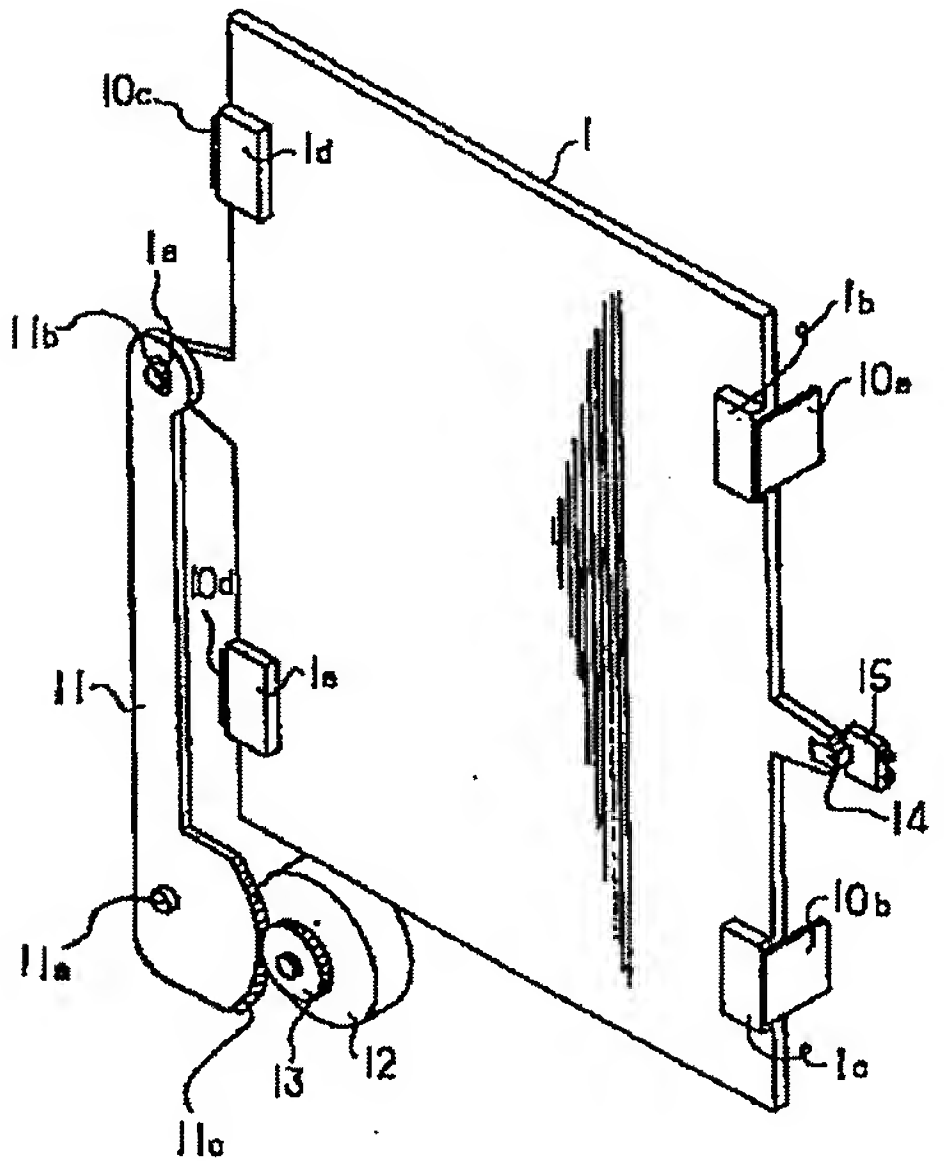
[Drawing 9]



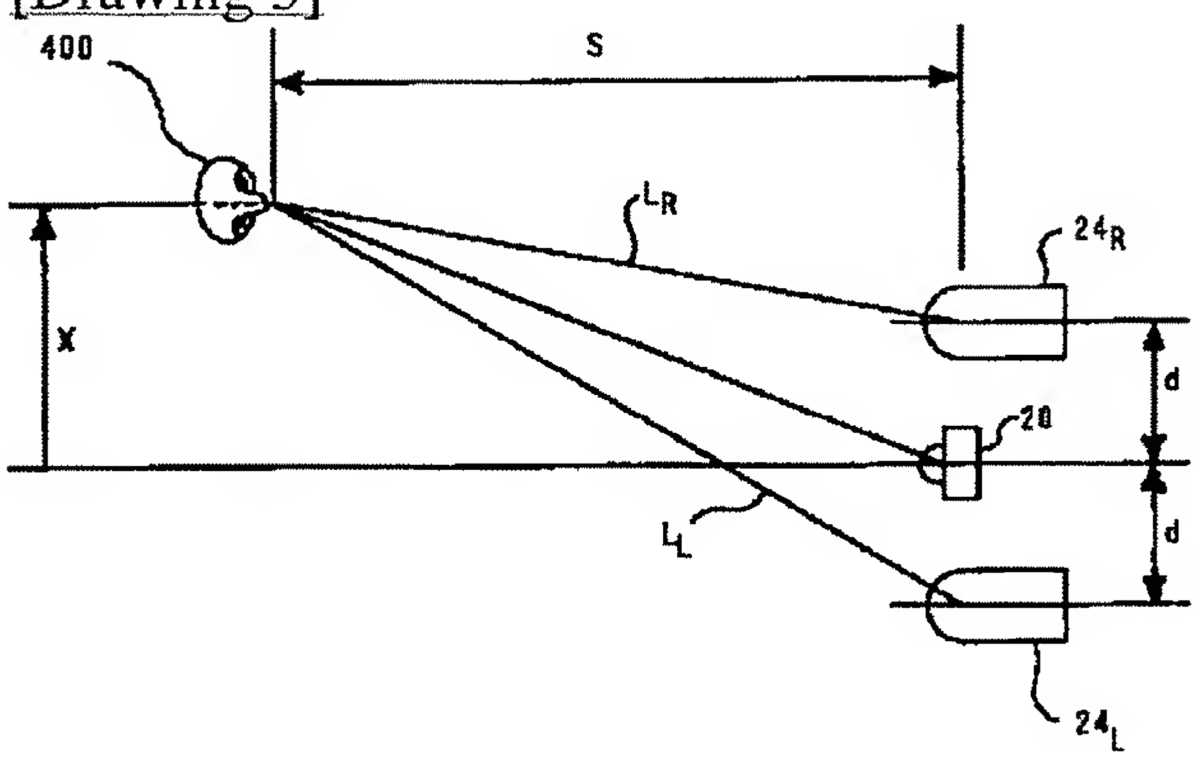
[Drawing 15]



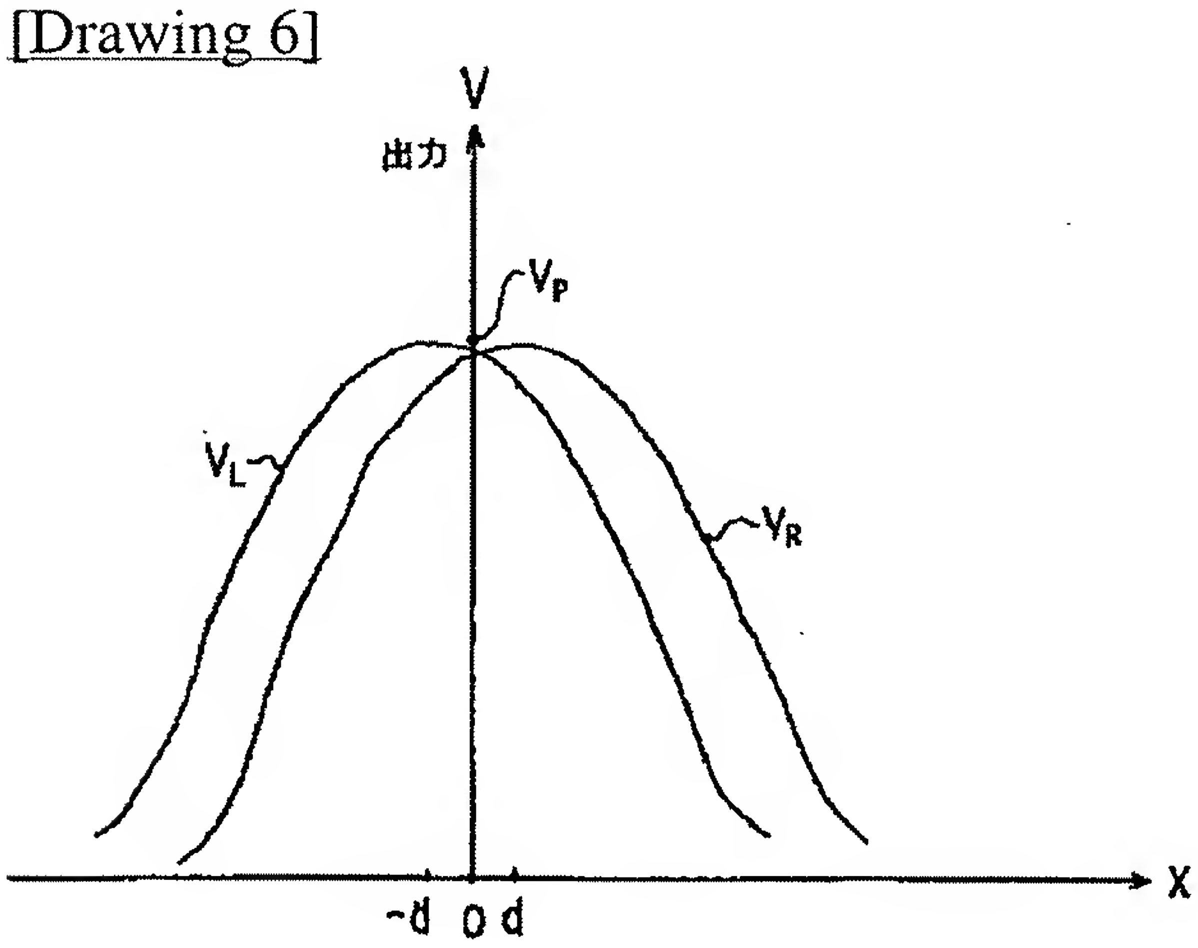
[Drawing 3]



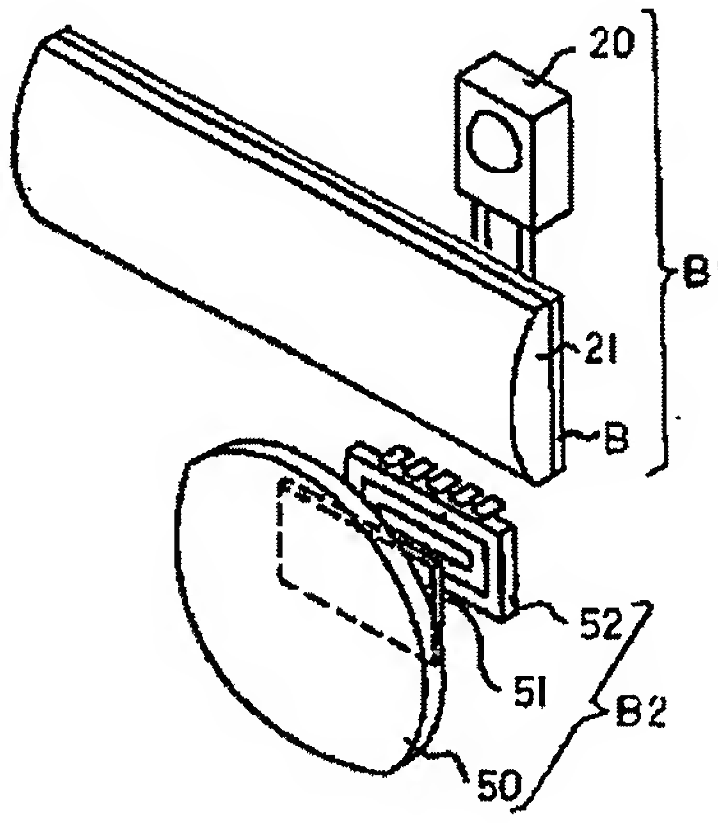
[Drawing 5]



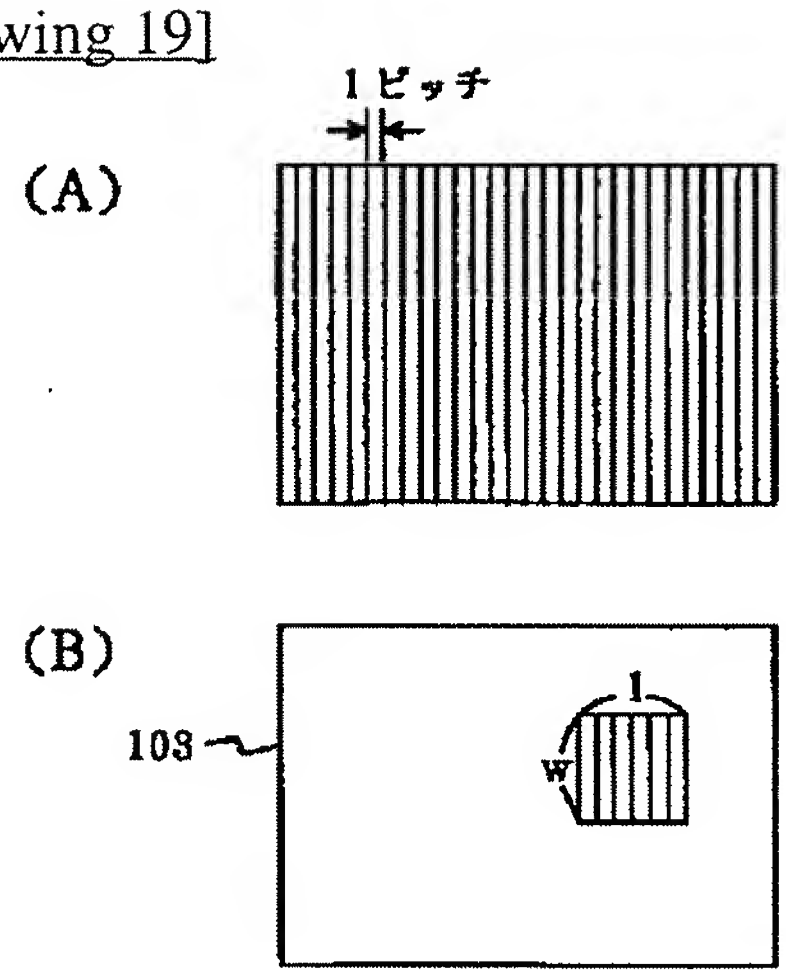
[Drawing 6]



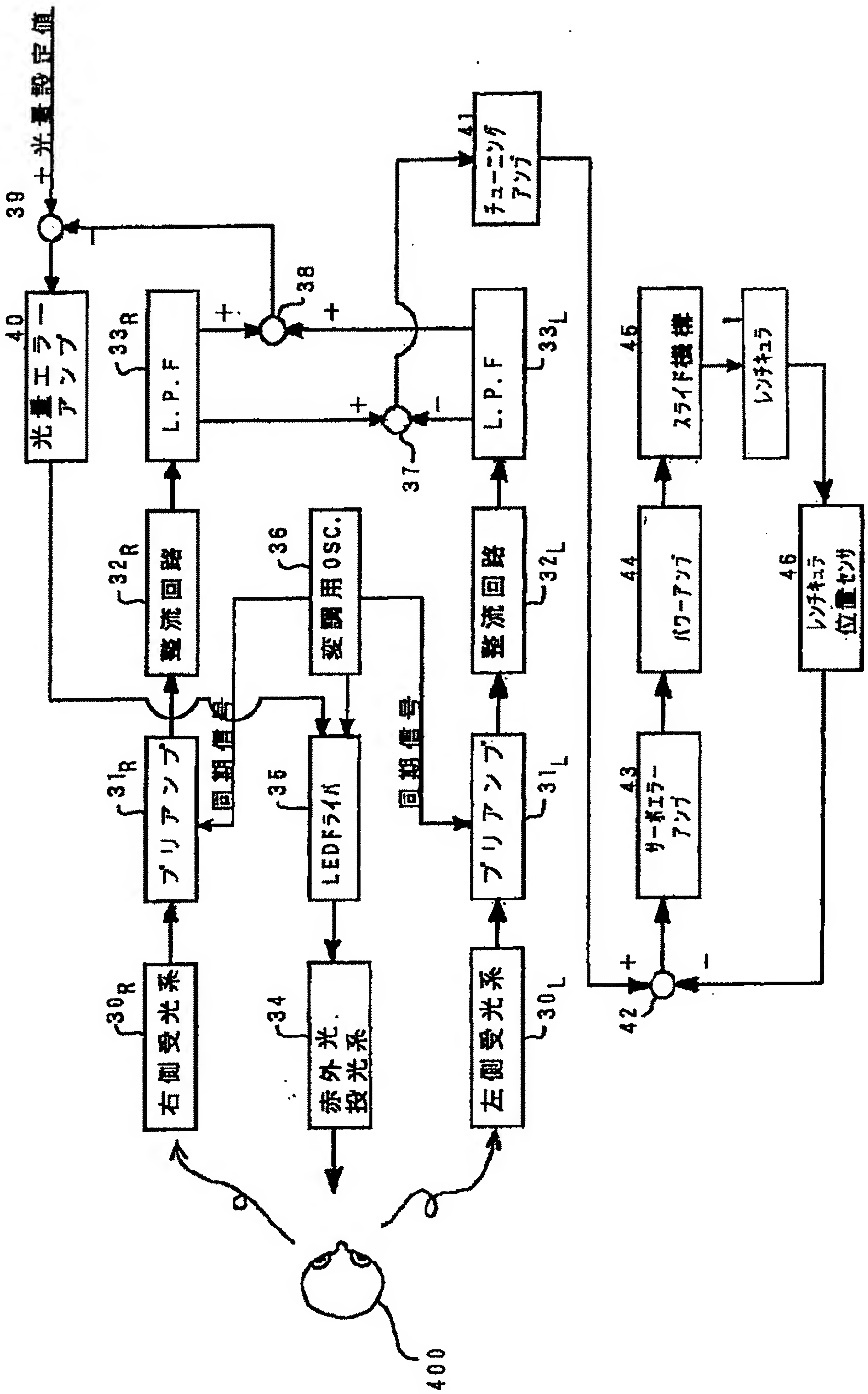
[Drawing 8]



[Drawing 19]

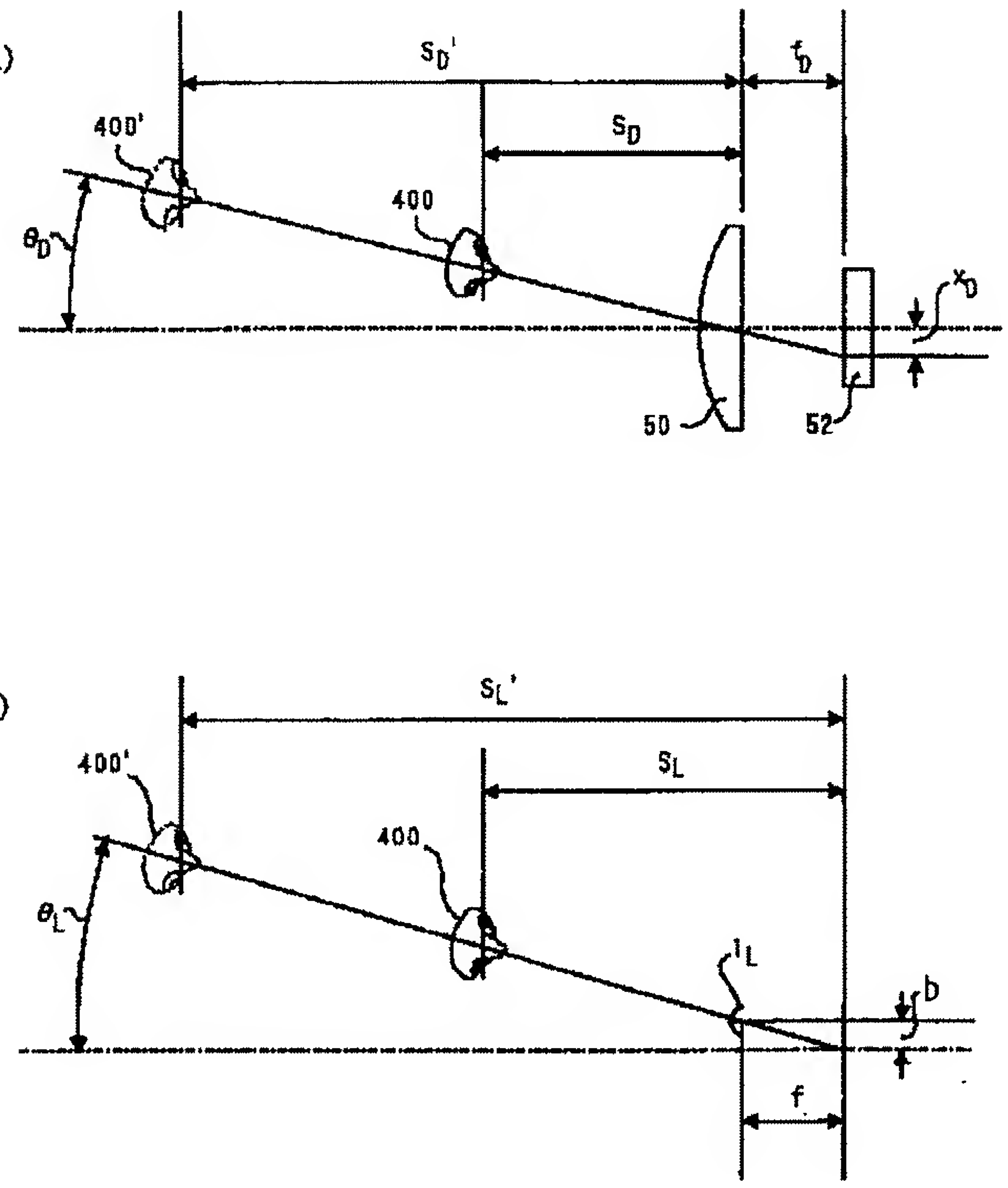


[Drawing 7]

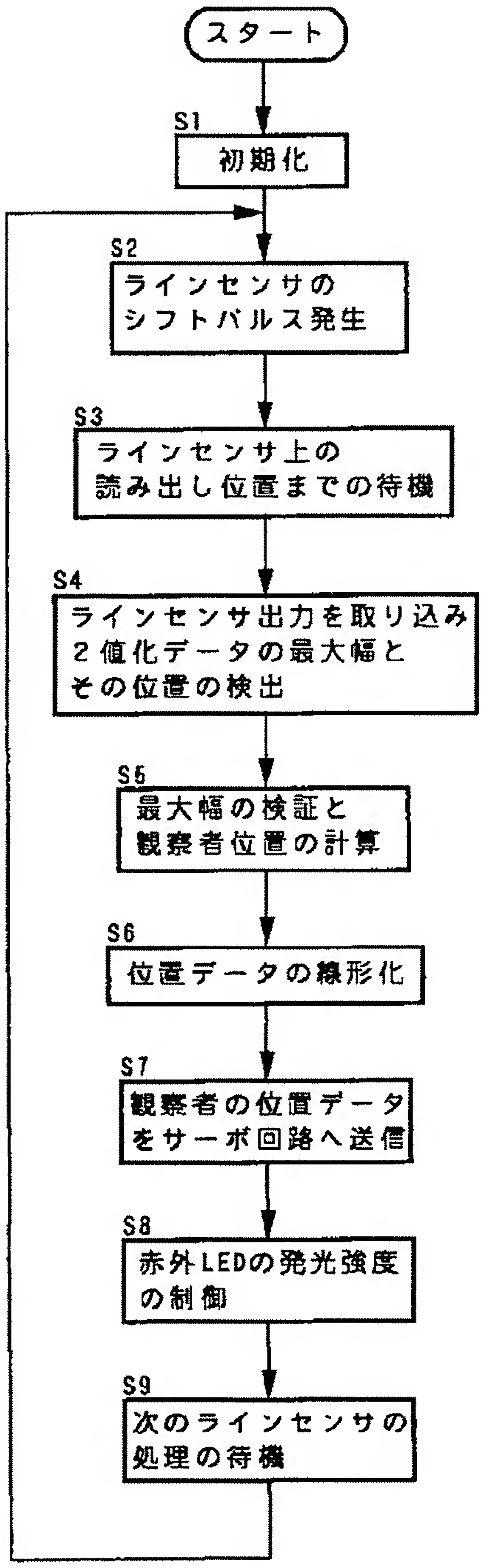


光量設定値
39
40
光量エラーアンプ
33R
L.P.F
38
41
チューニングアンプ
37
33L
L.P.F
45
スライド機構
レンチキュラ
32R
整流回路
36
変調用OSC.
32L
整流回路
44
パワーアンプ
46
レンチキュラ位置センサ
31R
プリアンプ
同期信号
35
LEDドライバ
同期信号
31L
プリアンプ
43
サーボエラーアンプ
30R
右側受光系
34
赤外光投光系
30L
左側受光系
42
400

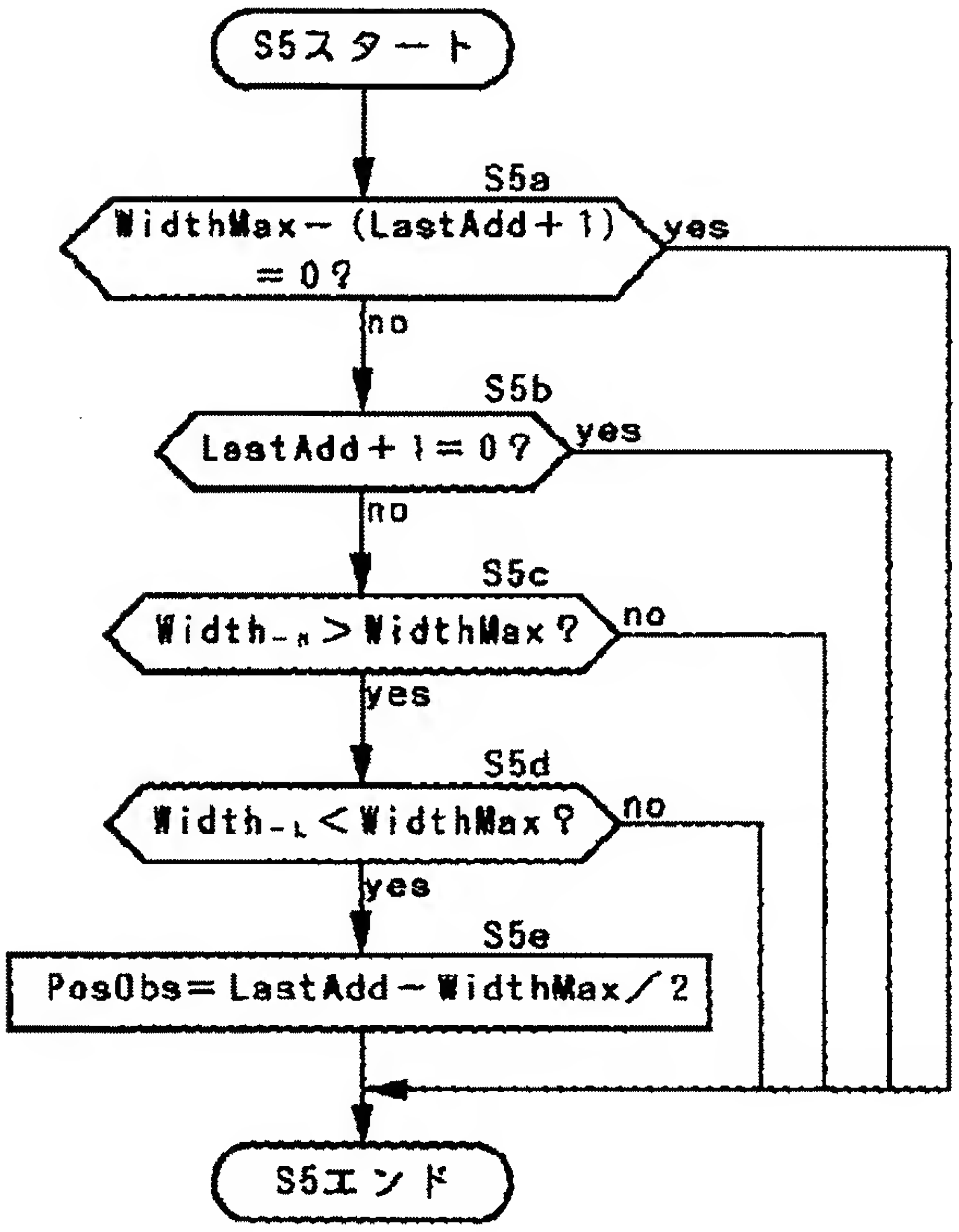
[Drawing 10]



[Drawing 12]

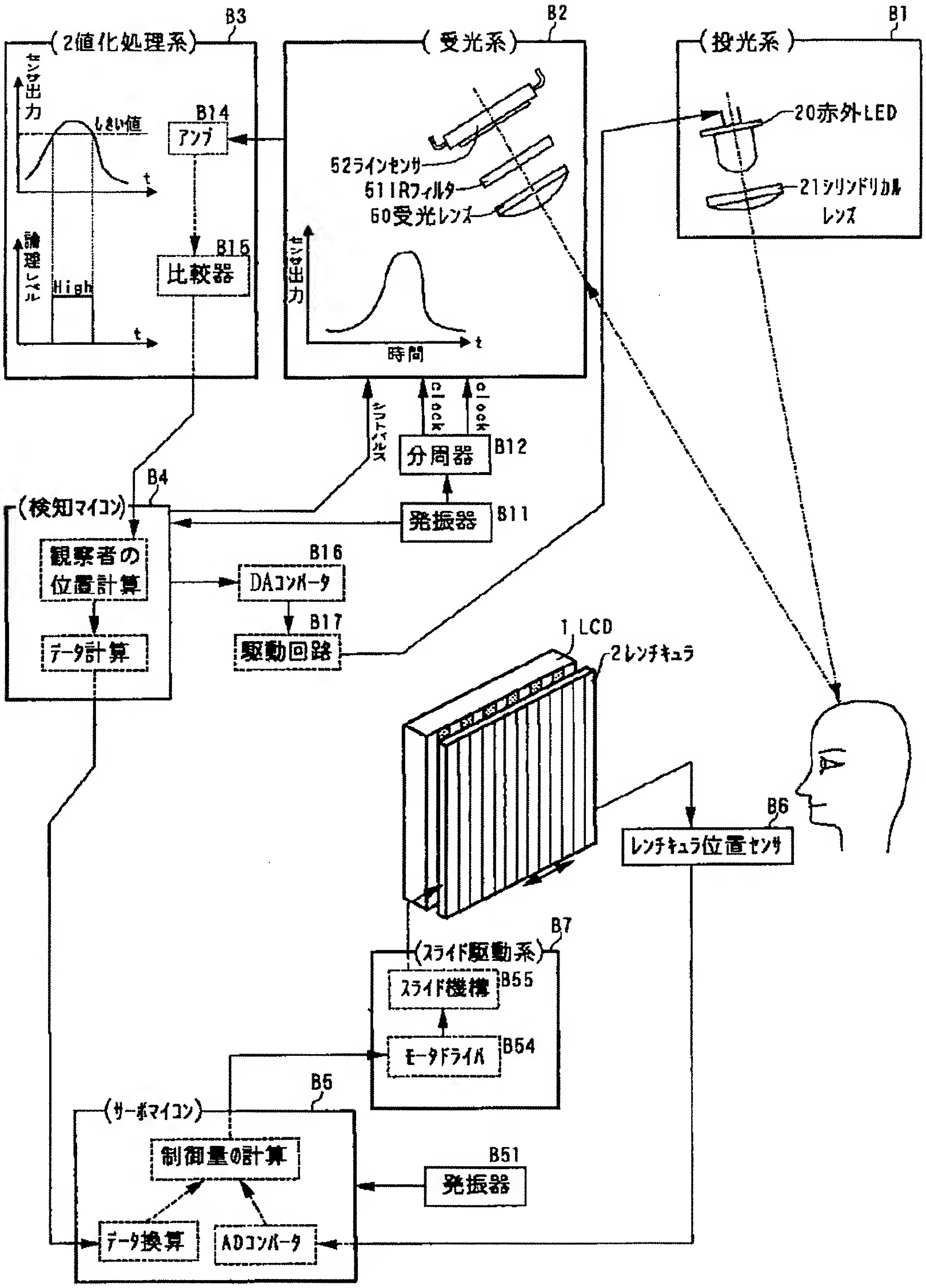

スタート
S1
初期化
S2
ラインセンサの
シフトパルス発生
S3
ラインセンサ上の
読み出し位置までの待機
S4
ラインセンサ出力を取り込み
2値化データの最大幅と
その位置の検出
S5
最大幅の検証と
観察者位置の計算
S6
位置データの線形化
S7
観察者の位置データ
をサーボ回路へ送信
S8
赤外LEDの発光強度
の制御
S9
次のラインセンサの
処理の待機

[Drawing 14]

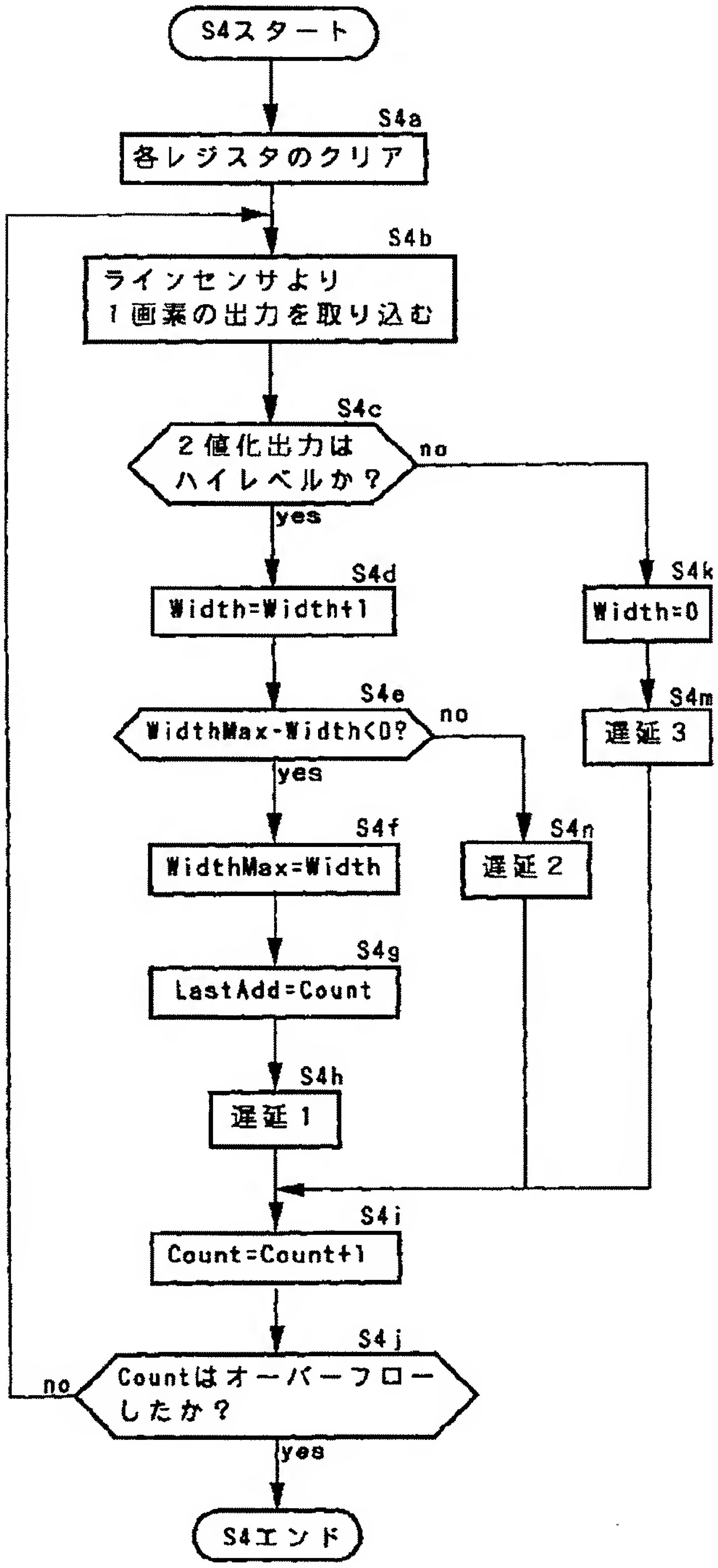


S5スタート
S5a
WidthMax－（LastAdd＋1）＝0？
yes
no
S5b
LastAdd＋1＝0？
yes
no
S5c
Width-R＞WidthMax？
no
yes
S5d
Width-L＜WidthMax？
no
yes
S5e
PosObs＝LastAdd－WidthMax／2
S5エンド

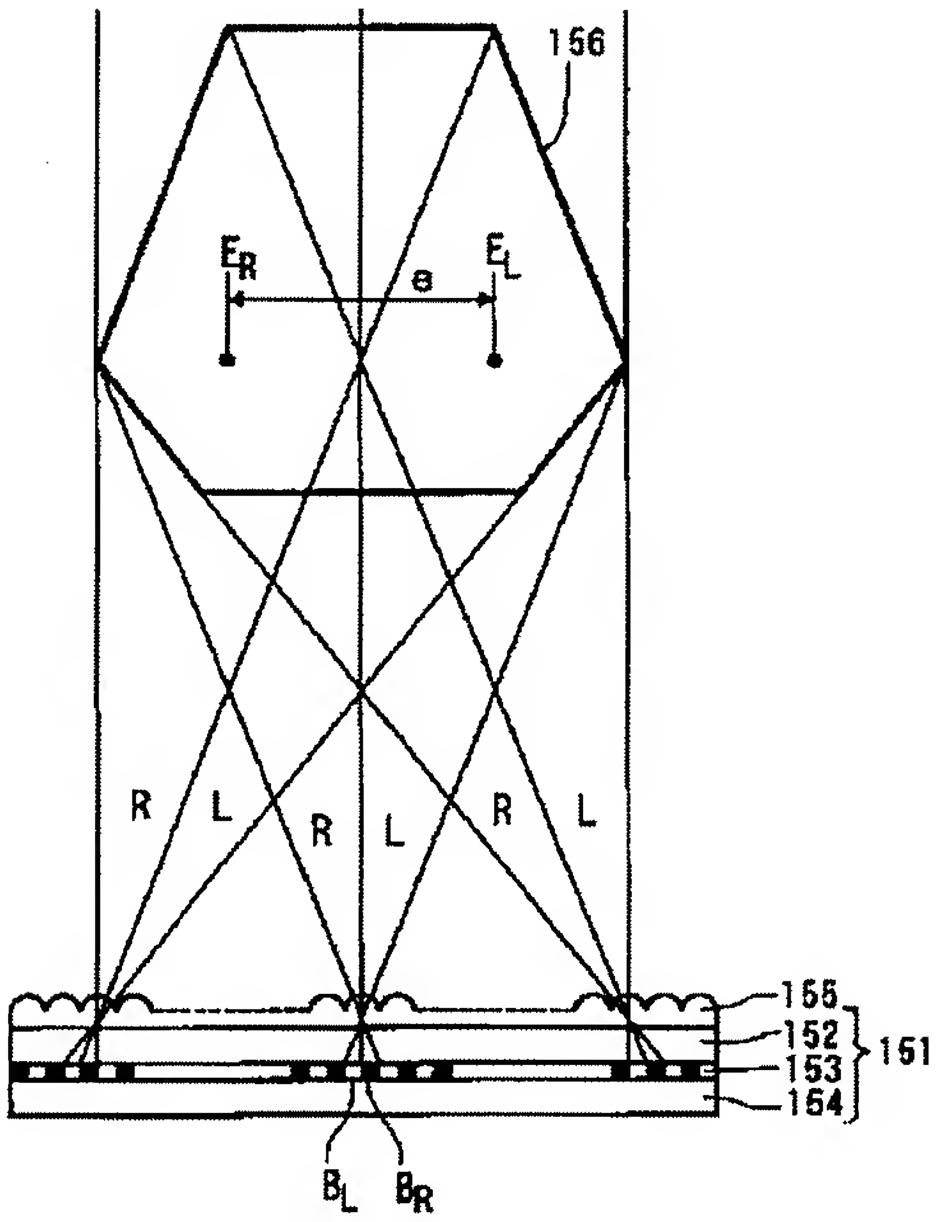
[Drawing 11]


B3
(2値化処理系)
センサ出力
しきい値
t
B14
アンプ
B15
比較器
論理レベル
High
t
B2
(受光系)
52ラインセンサ
51IRフィルタ
50受光レンズ
センサ出力
時間
t
B1
(投光系)
20赤外LED
21シリンドリカルレンズ
シフトパルス
clock
clock
分周器
B12
発振器
B11
B4
(検知マイコン)
観察者の位置計算
データ計算
B16
DAコンバータ
B17
駆動回路
1 LCD
2レンチキュラ
B6
レンチキュラ位置センサ
B7
(スライド駆動系)
スライド機構
B55
モータドライバ
B54
B5
(サーボマイコン)
制御量の計算
データ換算
ADコンバータ
B51
発振器

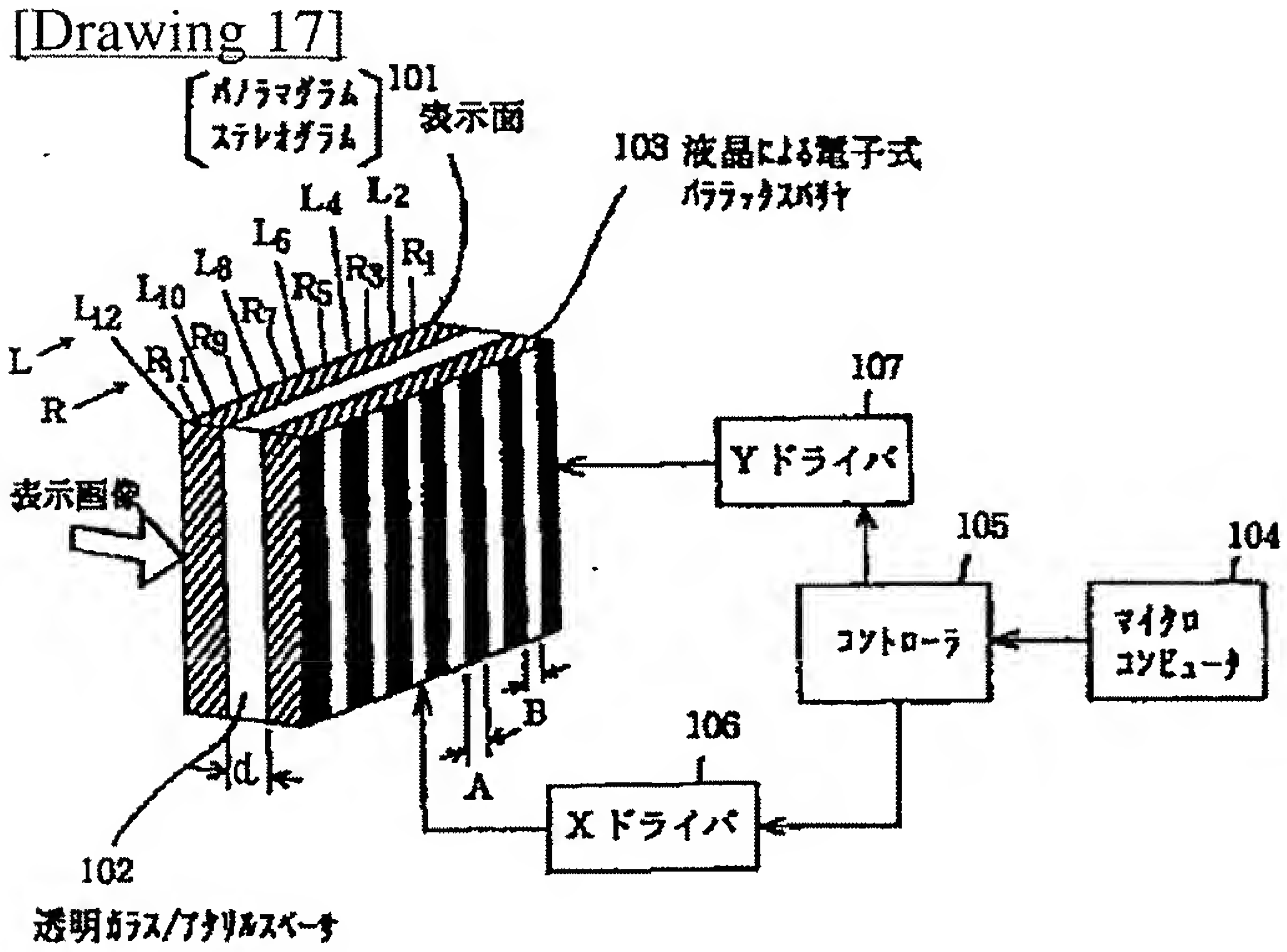
[Drawing 13]


S4スタート
S4a
各レジスタのクリア
S4b
ラインセンサより
1画素の出力を取り込む
S4c
2値化出力は
ハイレベルか？
no
yes
S4d
Width=Width+1
S4k
Width=0
S4e
WidthMax-Width<0?
no
S4m
遅延3
yes
S4f
WidthMax=Width
S4n
遅延2
S4g
LastAdd=Count
S4h
遅延1
S4i
Count=Count+1
S4j
Countはオーバーフロー
したか？
no
yes
S4エンド

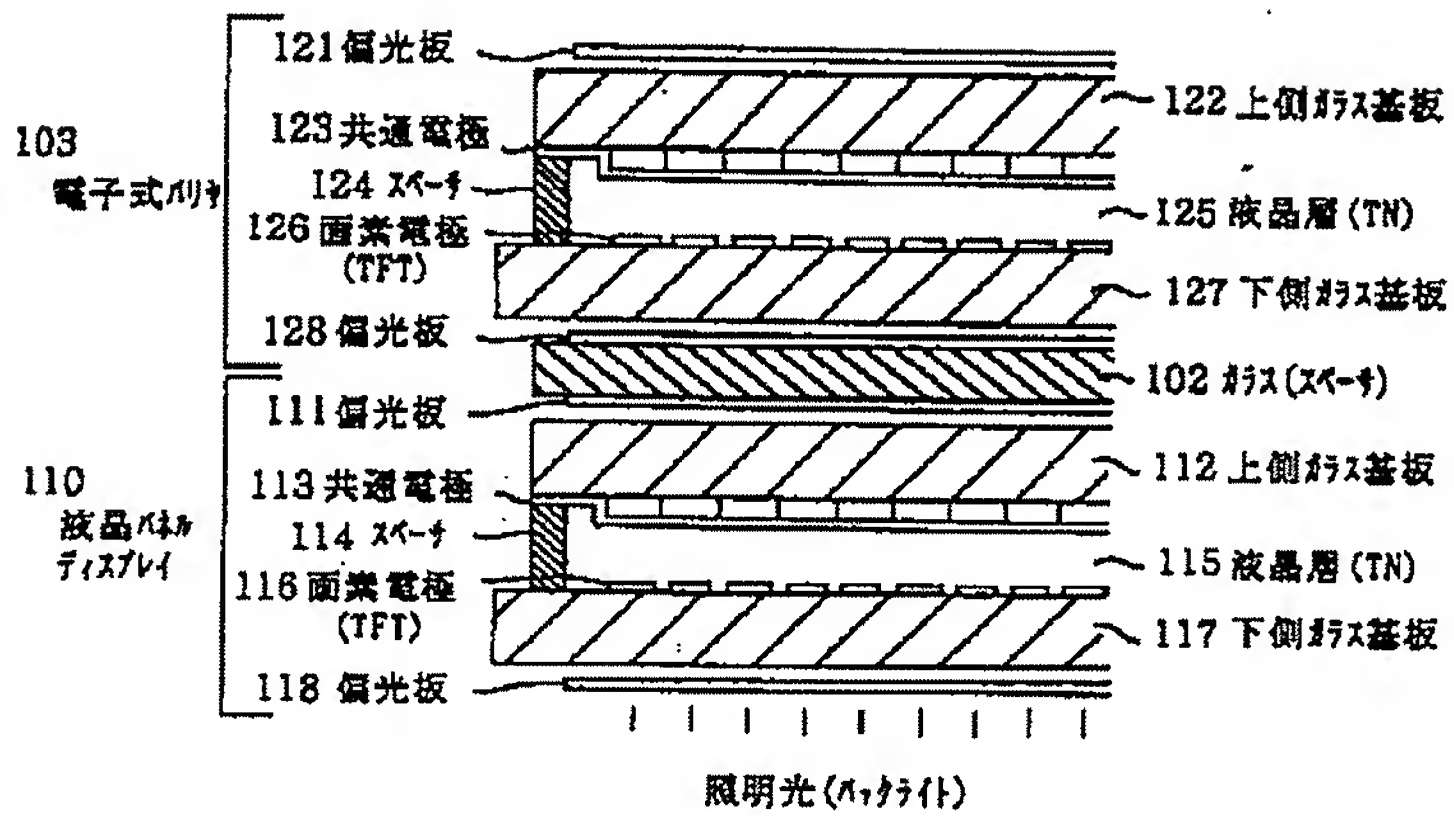
[Drawing 16]



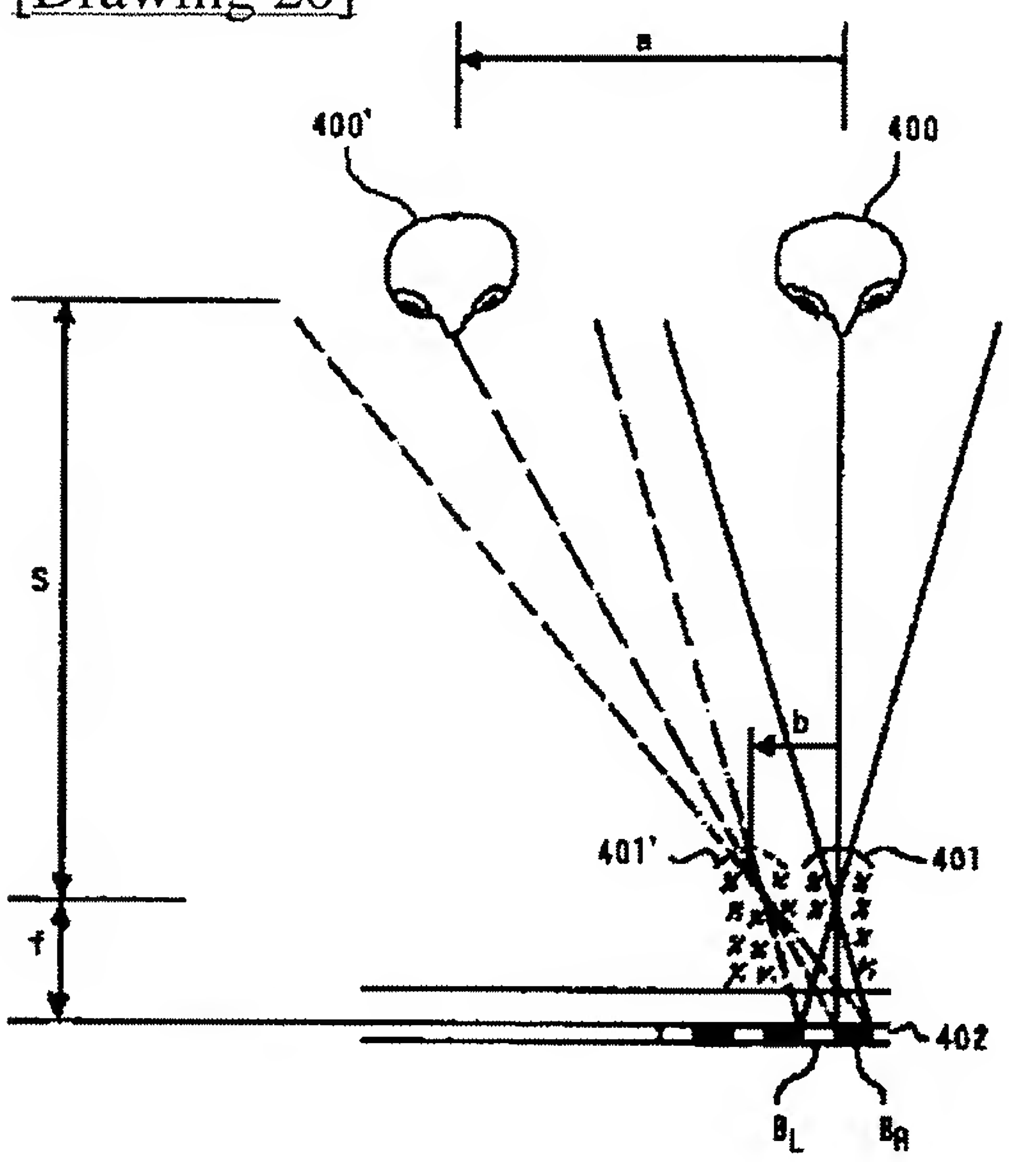
[Drawing 17]



[Drawing 18]



[Drawing 20]



[Translation done.]